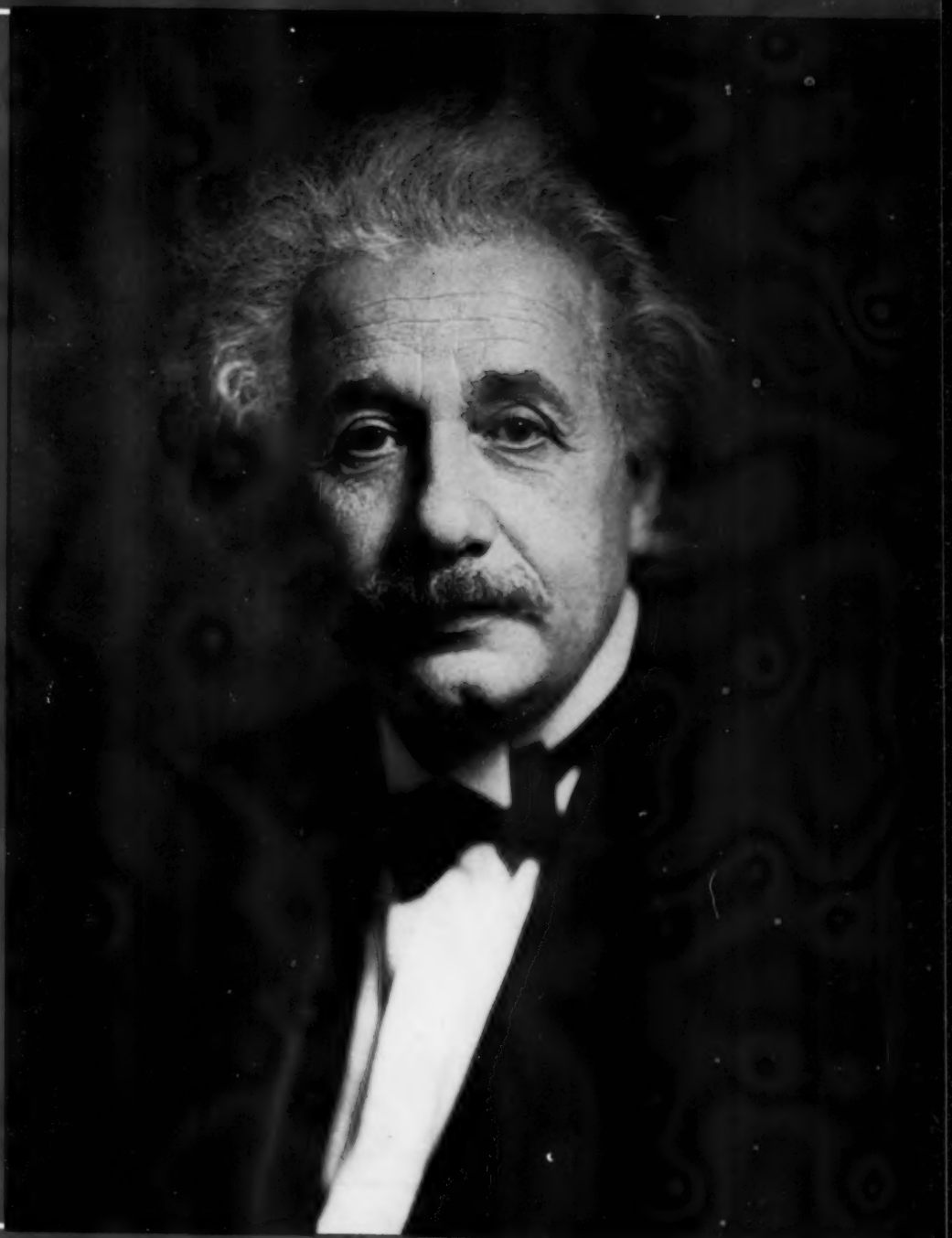
Vol. XXII, No. 3
APRIL 1955

THE SCIENCE TEACHER

- Method in Science Teaching
- The Friendly Insect
- Equipment for Elementary Science: Heat
- Directory of Summer Workshops and Courses
- The Principle of Relative Motion



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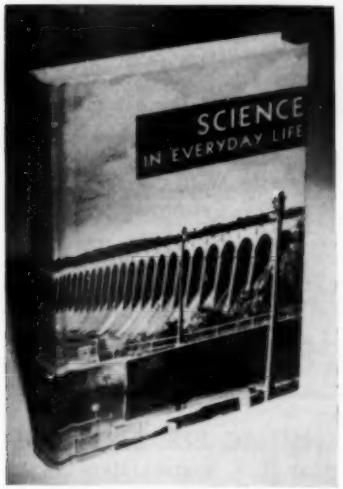

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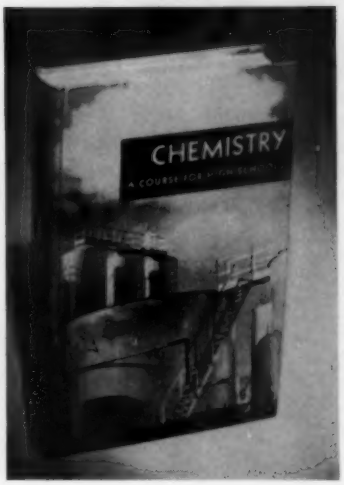

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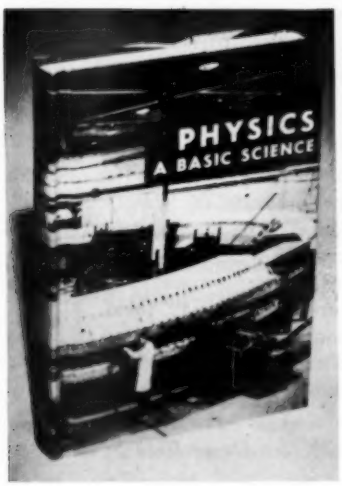

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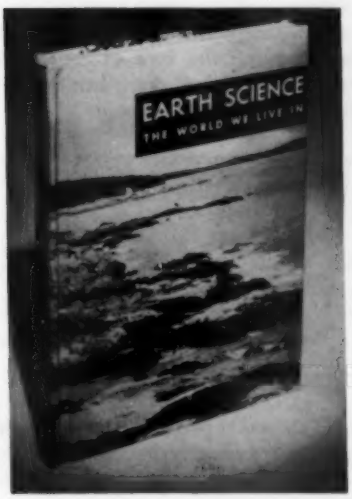

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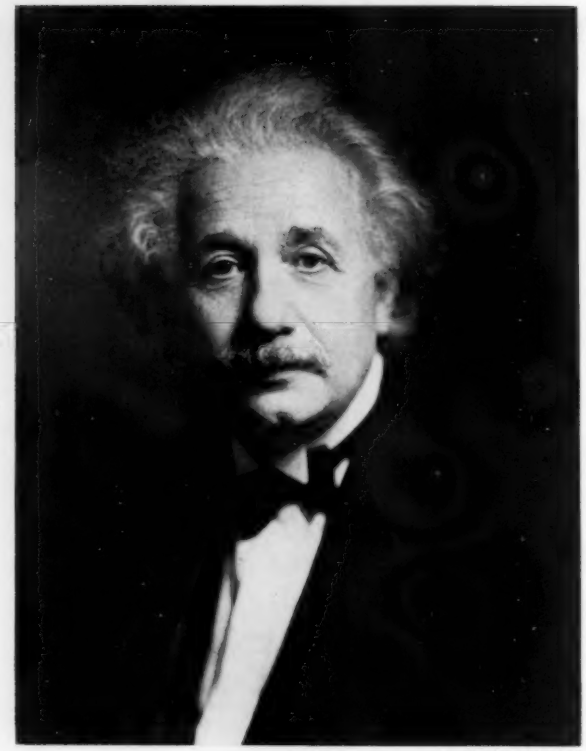

FABIAN BACHRACH

THIS MONTH'S COVER . . . Albert Einstein. Nothing that we could write would extend or deepen the realization that on April 18, 1955, there ceased to exist one of the gigantic, mathematical intelligences of all time. Though he was modest and humble and socially sensitive, Einstein's $E = Mc^2$ and other revelations will continue to affect human thought and living through the centuries to come. Science teachers are among the fore of those who mourn that death, as it must to all men, has come to this man.

Readers' Column

To All NSTA Members:

The action program of the National Science Teachers Association is both broad and thorough. While it is true that the Association has a sizable executive staff, the fact is that their functions are more along the lines of amassing activities than of developing them. This means that the major burden of professional education carried out by the Association falls on the shoulders of the membership-at-large.

We currently have some 25 professional committees working on behalf of the Association program. Those who have participated in committee activity have found it to be pleasant work and very rewarding in terms of professional development and personal friendships. If you find as *you* look over the existing committees in the forthcoming *1955 Membership Directory* that you want to have a share in the Association's committees, just drop a card to the president, or to the executive secretary.

Robert Stollberg, *President-elect*
San Francisco State College
San Francisco, California

I have been very proud to note the progress and growth of NSTA. As a life member, I was glad to learn that the Association plans to present Life Member Certificates. I regret that I can not make plans to receive mine at the Cincinnati Convention, but I shall look forward to receiving it in the mail and will be proud to display it in my office.

I hope that NSTA will continue to push for life membership as I feel that it is a great step toward making science teaching a strong profession.

Don O. Lyon
Public Schools
Iroquois, South Dakota

My sincere thanks for making arrangements that enable Mr. Gohman and myself to attend the national convention in Cincinnati. One is indeed humbled by the total stature of the program. Frankly, it is a most desirable challenge for the field of science teaching.

William J. Walsh
Iowa State Teachers College
Cedar Falls, Iowa

Please send me a few more flyers giving the rules for entering projects in the program of Science Achievement Awards for Students. The math department has become interested. Your FSA buttons are very popular this year. Last year's group wouldn't wear them and this year's group are fighting over them.

Hope your convention was a big success and that you'll have one in this area sometime. The magazine improves with every issue.

Sister Catherine Virginia
Notre Dame High School
Moylan, Pennsylvania

GIVE SCIENCE HEART

Oh, sober science teacher! Have you heard
That songs as well as eggs come from a bird?
And do you know—in your intensive hour—
That scents as well as seeds grow in a flower?
Let prose and poetry be well combined,
And give to science, heart as well as mind.

Hanor A. Webb
George Peabody College
for Teachers (Emeritus)
Nashville, Tennessee

THE SCIENCE TEACHER

The Journal of the National Science Teachers Association, published by the Association, 1201 Sixteenth Street, N. W., Washington 6, D. C. Membership dues, including publications and services, $4 regular; $6 sustaining; $2 student (of each, $1.50 is for Journal subscription). Single copies, 50¢. Published in February, March, April, September, October, and November. Editorial and Executive Offices, 1201 Sixteenth Street, N. W., Washington 6, D. C.

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Entered as second-class matter at the Post Office at Washington, D. C., under the Act of March 3, 1879. Acceptance for mailing at Special rate of postage provided for in the Act of February 28, 1925, embodied in paragraph (d), Section 34.40 P. L. & R. of 1948.

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This Issue . . .

of *The Science Teacher* concludes the spring series. The next issue will appear in September. Meanwhile, all NSTA members and subscribers are encouraged to: (1) send us changes of address so you will be sure to receive all issues of *TST* and other services; (2) send us suggestions for improving our professional journal; and (3) plan to become a *TST* author yourself. A pleasant summer to all! *The Editor.*

Editor's Column

If there is true value in "the biggest," the Cincinnati convention was it. We had 961 registrants. The banquet session attracted 441 persons and the Ohio luncheon 243. The exposition of science teaching aids included 45 booth exhibits and the largest linear footage of teacher and student displays. More small groups met in "eat and work" sessions than ever before—30 for the Life Members' breakfast, about 40 for the Junior Academy dinner, and 24 for the supervisors dinner. About 40 state and area directors met with the chairman of the Membership Committee and a number of other smaller committees also held get-togethers.

But the real pay-off is not in numbers alone. How do people "feel" about it after the show is over? Judging from first—and second-hand accounts, everyone left Cincinnati with renewed enthusiasm and a feeling of warmth and satisfaction. Much of this was undoubtedly the result of superb management by local committees; the wheels were well greased and things went smoothly. Another major factor, of course, is the program itself. Comparisons with the past are out of order, but the Cincinnati program committee can rest assured that the hundreds of man-hours devoted to planning did pay off. Solid information, inspiration, practical "workbench ideas"—all these and more were included.

But there is still more to a convention. Meeting old friends, making new ones, informal exchanges of experiences and ideas, and social activities—in many ways these are the high points. These "intangibles" provide a real lift and send you home just downright happy to be a part of it all. Here is one of the reasons why sending a science teacher to the NSTA convention is one of the best investments a school board can make. This summary of the replies from 626 registrants to our questionnaire on "Who paid the bill?" may be of interest to your Board. (Full expenses—151; partial expenses—136; no expenses—138; released time with substitute—175; released time, loss of pay—3; and other—23.)

How will the convention be reported? Most if not all major addresses will be published in future issues of *TST*. Reports of the discussion groups and some of the other panel sessions will be included from time to time in the Packets. And you can be pretty sure that the 961 people who were there are going to tell a lot of others about it.

Next, of course, is the 1956 convention in Washington, D. C. The program committee held its first planning session in Cincinnati. They will meet again for three days in May. You, too, can have a part in the planning—and you can do it NOW. Send your ideas, suggestions, gripes, etc. directly to the chairman: Mr. Henry A. Shannon, Adviser for Science and Mathematics, State Department of Public Instruction, Raleigh, North Carolina.

Robert H. Carleton

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THE SCIENCE TEACHER

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The National Science Teachers Association is a department of the National Education Association and an affiliate of the American Association for the Advancement of Science. Established in 1895 as the NEA Department of Science Instruction and later expanded as the American Council of Science Teachers, it merged with the American Science Teachers Association and reorganized in 1944 to form the present Association.

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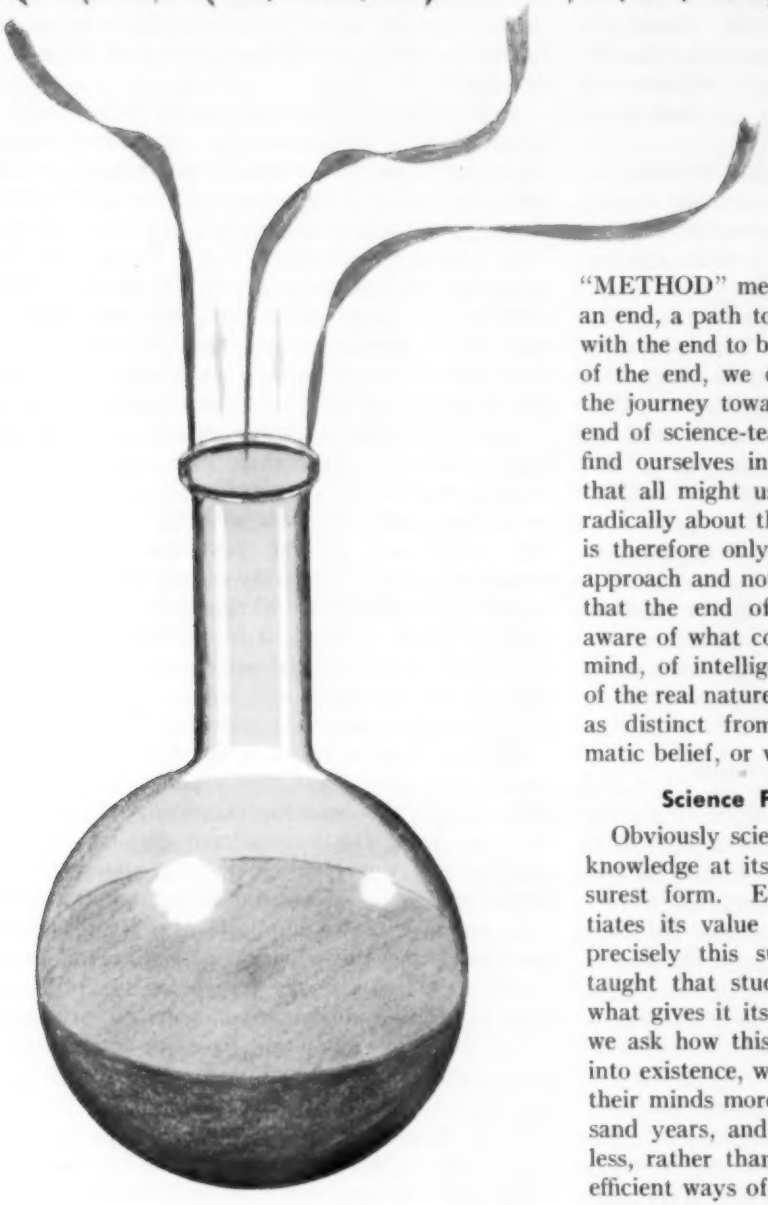
METHOD IN SCIENCE TEACHING



Can you identify the author of this article? When and where was it presented? You will find the answers to these questions on page 160. *Editor.*

"METHOD" means a way to a result, a means to an end, a path to a goal. Method therefore varies with the end to be reached. Without a clear notion of the end, we cannot proceed intelligently upon the journey toward it. When we try to state the end of science-teaching, we are, however, likely to find ourselves involved in such vague generalities that all might use the same words and yet differ radically about the actual method of procedure. It is therefore only to make clear my own point of approach and not to foreclose discussion that I say that the end of science-teaching is to make us aware of what constitutes the most effective use of mind, of intelligence; to give us a working sense of the real nature of knowledge, of sound knowledge as distinct from mere guesswork, opinion, dogmatic belief, or whatever.

Science Fundamental in Education

Obviously science is not only knowlege, but it is knowledge at its best, knowledge in its tested and surest form. Educationally, then, what differentiates its value from that of other knowledge is precisely this superior quality. Unless it is so taught that students acquire a realizing sense of what gives it its superiority, something is lost. If we ask how this superior type of knowledge came into existence, we find that men have been working their minds more or less effectively for many thousand years, and that for a very long time it was less, rather than more, effectively. But the most efficient ways of using or working intelligence have gradually been selected and cultivated. And science as a personal power and resource is an equipment of those found most successful, most effective.

A man may have a great deal of cultivation, a great deal of information, correct information at

that, about things, but if he has never made a first-hand acquaintance at some point with scientific ways of dealing with a subject-matter, he has no sure way of telling the difference between all-wool knowledge and shoddy goods. He has no sure way of knowing how, or when, he is using his mental powers most capably and fruitfully. The ability to detect the genuine in our beliefs and ideas, the ability to control one's mind to its own best working is a very precious thing. Hence the rightful place of science in education is a fundamental one, and it is correspondingly important to see to it that methods of teaching are such as to fulfil its true purpose.

When we pass from this generality, it seems to me that the first need is to discriminate certain stages in the educational development of science. The first stage belongs, of necessity, to the elementary school; for I do not think that any amount of pains and ability in the high school can make up for a wrong start, or even a failure to get the right start, in the grades. This is contrary in appearance to a common assertion of secondary teachers, that they prefer that their pupils come to them without any science instruction at all—which is paralleled by a similar statement on the part of college teachers.

I think the inconsistency is only in appearance. *The remark is really proof of the necessity of a right start.* I do not believe that the problem of successful science will be met until teachers in college and high school exchange experience with those in the elementary school, and all take a mutual interest in one another's work.

Science in Elementary Schools

At this stage the purpose should be to give a first-hand acquaintance with a fair area of natural facts of such a kind as to arouse interest in the discovery of causes, dynamic processes, and operating forces. I would emphasize the phrase "of such a kind." I think the chief defect, upon the whole, in our present elementary nature-study is that, while it may arouse a certain interest in observation and accumulate a certain store of information, it is too static, and hence too miscellaneous. By "static" I mean that observation is not directed to some active process. No amount of information of this sort can supply even a background for science. Space, however, forbids my dwelling upon this point, and its underlying point can perhaps be brought out by reference to something which lies within the high-school program, namely, so-called "general science."

Like the nature-study movement, the tendency to general science courses is animated by a praiseworthy desire to get away from the specialized technicalities of a highly matured science. I will not say that these reduce themselves, for the average beginning student, to mere acquisition of a vocabulary, though there is danger of this. But, except with the few, this science of the accomplished specialist remains, even when fairly well understood, just an isolated thing, a thing of a world superadded to the everyday world, when it ought to be an enlightening and an intellectual control of the everyday world.

As an attempt to get back nearer to the world in which the pupil lives, and away from a world which exists only for the scientist, the general-science tendency has, as I have just said, its justification. But I have an impression that in practice it may mean two quite different things. It may take its departure from sciences which are already differentiated, and simply pick out pieces from them—some from physics, some from chemistry, some from physiography, some from botany, etc.—and out of this varied selection form something to serve as an introduction to sciences in a more specialized form. Now this method I believe to be of the static type after all. It gives scope for variety and adaptation, and will work with the right teacher. But, urged as a general movement, I believe it retains the essential mistake of any method which begins with scientific knowledge in its already-made form, while in addition it lends itself very easily to scrappy and superficial work, and even to a distaste for the continued and serious thinking necessary to a real mastery of science.

General science may, however, have another meaning. It may mean that a person who is himself an expert in scientific knowledge forgets for the time being the conventional divisions of the sciences and puts himself at the standpoint of pupils' experience of natural forces, together with their ordinary useful applications. He does not, however, forget the scientific possibilities of these experiences, nor does he forget that there is an order of relative importance in scientific principles —that is to say, that some are more fundamental, some necessary in order to understand others, and thus more fruitful and ramifying.

While, then, he may take his subject-matter from any of the ordinary and more familiar materials of daily life, he does not allow that material, in its obvious and superficial form, to dictate to him the nature of the subsequent study. It may be varnish, or cleansers, or bleaches, or a gasoline engine. But he never for a moment allows in his educational planning, that thing to become the end of study;

when he does, we have simply the wrong kind of elementary nature-study over again. To him, as a teacher, the material is simply a means, a tool, a road. It is a way of getting at some process of nature's activity which is widely exemplified in other phenomena, and which, when grasped, will render them more significant and more intelligible. While the student's attention may remain, so far as his conscious interest is concerned, upon the phenomena directly in front of him, it is the teacher's duty to see that he gets below the surface to the perception of whatever is scientifically in the experience. This need not be labeled a principle or law—in fact, if it is so labeled at first, the name "principle" or "law" will be merely a label. But if further material is selected so that what the pupil got hold of before serves as a means of intellectual approach and understanding, it becomes a principle or law for him; a law of his own thinking and inquiries, a standpoint from which he surveys facts and attempts to reduce them to order.

This same method of procedure means, of course, that choice is made in fixing the kind of familiar material with which one sets out. The interests and occupations of the environment will play a part. A farming environment would tend to provide one point of departure, a district in which electric apparatus were made, another, a railway center a third, and so on. But in each case there will always be room for choice between material which tends to begin and end in itself, and that from which something may be easily extracted which will give pupils a momentum to other things.

My point may perhaps be stated by saying that the right course lies between two erroneous courses. One method is the scrappy one of picking up isolated materials just because they happen to be familiar objects within the pupil's experience, and of merely extending and deepening the range of the pupil's familiarity, and then passing on to something else. No amount of this process will make an introduction to science, to say nothing of science, for an introduction leads or draws into a subject, while the scrappy method never, save by accident, gets the pupil within range of the problems and explanatory methods of science.

The other erroneous course is taken when the teacher's imagination is so limited that he cannot conceive of science existing except in the definitely segregated areas, concepts, and terms which are found in books under the heads of "physics," "chemistry," etc., and who is thus restricted to moving within these boundaries. Such a person forgets that there is no material in existence which is physical or chemical or botanical, but that a certain ordinary subject-matter becomes physical or chemical or botanical when certain questions are raised, and when it is subjected to certain modes of inquiry. What is desired of the pupil is that, starting from the ordinary unclassed material of experience, he shall acquire command of the points of view, the ideas and methods, which make it physical or chemical or whatever.

The Core of Understanding in Science

I return to what I said at first about the dynamic point of view as the really scientific one, or the understanding of process as the heart of the scientific attitude.

What are called "physics" and "chemistry" deal in effect with the lawful energies which bring about changes. To master their methods means to be able to see any observed fact, no matter how seemingly fixed and stubborn, as a change, as a part of larger process or ongoing. In this sense they are central (along with mathematics which only deals with the fixed, the formal and structural side of the fact) in all scientific understanding. There is a sound instinct in the tendency to insist upon them as the heart of the secondary course in science and to look with jealousy upon whatever narrows their sphere of influence. But it does not follow that the material which is found in the texts which segregate certain considerations under the heads of physics or chemistry is the material to begin with. That is the fallacy against which I have been arguing. Plant and animal life, the operations of machines, and the familiar appliances and processes of industrial life are much more likely to furnish the actual starting material. What the principle calls for is that the pupil shall be led in his study of plant and animal life, of the machine and its operations, to the basic operations which enable him to understand what is before him—to be led inevitably to physical and chemical principles.

Nothing is more unfortunate for education than the usual separation between the sciences of life and the physical sciences. Living phenomena are natural and interesting material from which to set out, especially in all rural environments. But they are educationally significant in the degree in which they are used to procure an insight into just those principles which are not plants and animals, but which, when they are formulated by themselves, constitute physics and chemistry. It is the failure to carry nature-study on to this insight which is responsible for its pedagogically unsatisfactory character, and the movement toward general science will repeat the failure unless it keeps the goal of physical and chemical principles steadily in view.

An extension of the method I have spoken of should, in my judgment, constitute the bulk of the secondary course in science, which ideally should be continuous throughout the four years—or the six. We must remember that, although in school we are always treating pupils as embryonic scientists who somehow are interrupted and cut off before they get very far, the great mass of the pupils will never be scientific specialists. The value of science for them resides in the added meaning it gives to the usual occurrences of their everyday surroundings and occupations. None the less, we want a high school which will tend to attract those who have a distinct calling for specialized inquiry, and one which prepares them to enter upon it. I can only express my belief that there are many more such in the pupil population than we succeed at present in selecting and carrying on; and that I believe this is largely because we follow to so great an extent the method of feeding them all from the start as if they were full-fledged, minute specialists. As a result, larger numbers who might otherwise be drawn later into the paths of scientific inquiry now become shunted off into the more concrete and appealing paths of engineering, industrial invention, and application, simply because they have been repelled by a premature diet of abstract scientific propositions.

I believe there are scores, if not hundreds, of boys, for example, who now go from courses of abstract physics into automobile factories and the like, who, if they had begun with the automobile under a teacher who realized its scientific possibilities, might have gone on into abstract physics.

I can sum up by saying that it seems to me that our present methods too largely put the cart before the horse; and that when we become aware of this mistake we are all too likely to cut the horse entirely loose from the cart and let him browse around at random in the pastures without going anywhere. What we need is to hitch the horse of concrete experience with daily occupation and surroundings, to a cart loaded with specialized scientific knowledge. It is not the duty of high-school science to pack the cart full—that will come later. It is its part to make such a good job of the hitching that every pupil who comes under its influence will always find in himself a tendency to turn his crude experiences over into a more scientific form, and to translate the bare science he reads and hears, back into the terms of his daily life. When we do this we shall find, I am confident, the crop of scientific specialists increased, not diminished, while we shall have a citizenship of men and women really intelligent in judging the affairs of life.

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The Training of Science Teachers in a UNIVERSITY EDUCATION DEPARTMENT

By R. W. CROSSLAND

Lecturer in Education, Manchester University, England

COURSES for the training of teachers follow a fairly uniform pattern. Philosophy, psychology, history and health, as applied to education, form the basis of most courses, together with special method courses on the teaching of specific subjects of the school curriculum. Optional courses on such matters as visual aids, art and crafts, drama, construction and repair of scientific apparatus, and physical education may also contribute directly or indirectly to the training of a specialist subject teacher. It is the purpose of this article to discuss some aims of a special method course on the teaching of science for prospective teachers of science in grammar schools.

It is assumed that a student's teaching practice in a grammar school is the most important part of his training. Usually this period of practice is all too short, and a considerable portion of the time of a method course could be profitably used in showing students how to make the most efficient use of their school practice. At the school the student can get first-hand experience of the teaching programme day by day, week by week, term by term and year by year; he can study laboratory layout and management, the purchase and storage of equipment, the selection and organization of the course content, the choice and use of books and other instructional aids and many more duties of the science teacher. By careful planning, in co-operation with the head master and science staff, of his teaching and lesson-observation timetable, the student can teach and see taught, pupils of different ages and abilities, both in the classroom and in the laboratory, and he can gain practice in the setting and follow up of homework and attainment tests.

First Aim—Training as a Subject Specialist

On entering a university department of education most teacher-trainees are keen to qualify themselves to teach their special subject to an advanced level, and particularly to the Sixth Form. They have their own ideas—usually conservative and based on their schoolday experiences—on how to teach physics, or chemistry, or biology, and are eager to try them out in school practice. The first aim of a science method course should be to foster the student's enthusiasm for teaching his special subject, and it is obvious to tutors that *students appreciate most that part of the method course which deals with the practical side of teaching their special subject.*

Second Aim—Training as a General Science Teacher in the Lower School

The second aim of a method course should be to get the students to consider the wider and more

This article discusses some current practices, problems, and philosophy involved in the training of science teachers in England. The parallels with the situation in our country are most striking. We have taken editorial license to italicize throughout the article those passages which, to us, point to common criticisms, concerns, and viewpoints.

Dr. Crossland is an enthusiastic and active member of NSTA. He and your editor have exchanged many letters covering a variety of topics. Permission to reprint this article is one result of this correspondence. Reprinting was approved both by the author and by the editor of *The Bulletin of Education* of the Association of Teachers in Colleges and Departments of Education, in which it was originally published (No. 32, November, 1953).

Be assured that Dr. Crossland will welcome hearing from those who may be interested to correspond, socially or professionally on matters of concern implied in this article. Those interested in obtaining copies of *The Bulletin of Education* may find out how to do so from him or from the publication office: ATCDE, 469 Oxford Street, London, W. 1., England.

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realistic problem of teaching their subsidiary science subjects in the lower school. This will involve a consideration of the aims of teaching science in schools and the relative merits of general science and separate science subjects. It is the writer's opinion that *all new science teachers should be able to teach general science to the first three forms of a grammar school and their special subject up to an advanced level.*

The movement to introduce general science into schools is now thirty years old and we still hear some of the same objections to it that were put forward in the early days of the movement. One of these objections is relevant to the present discussion, namely, the argument that a specialist in the physical sciences is not qualified to teach biology or vice versa. It is more usual to find a physicist, and slightly less usual a chemist, who knows very little biology than to meet a biologist with very little knowledge of physics; and most biologists have a better knowledge of chemistry than of physics.

How long is this situation to go on? *Are we in a position to decide that general science is the best initial training for all secondary school pupils and to train all science teachers so that they are qualified to teach general science at least the first two or three forms?* The answer to this question depends on three main factors, which a method tutor should discuss with his students.

The first factor is concerned with a wider problem, now a much discussed topic by educationists of all kinds: that of the relative merits of specialization and general education. The specialists say that a thorough training in one science subject is the best way of understanding science, that a prolonged experience of a limited range of phenomena makes the most lasting impression, and that one, two or all three of the usual school science subjects must be taken separately from Form I onwards in order to prepare for the advanced courses in the Sixth Form and at the university. They would also say that a general education springs from a hard core of specialist study. Those against a too early specialized study say that all pupils in the lower and middle school require a general course covering the whole field of science, respecting no artificial subject barriers, and some claim that such a course can be a satisfactory preparation for specialized work in the Sixth Form. We have the evidence in support of the latter claim from a few schools which prepare all their pupils for the General Science I paper of the General Certificate of Education of the Northern Universities Joint Matriculation Board, and in addition prepare the fu-

ture science specialists for the General Science II paper; science teachers at these schools maintain that this system is adequate preparation for Sixth Form work.

The second factor is the nature of the science degree courses at the universities. Special honours courses in physical sciences rarely include a subsidiary biological subject, and courses in biological sciences usually exclude either physics or chemistry. The introduction by some universities of honours degree courses in general science has not improved the situation much. With very few exceptions scientists entering the teaching profession today are still specialists in one or two subjects; they are unhappy about their ability to teach a third science, and they think of science in terms of rigid compartmentalized subjects. *This situation leads us to ask whether degree courses in science as usually taught in the universities are appropriate to the needs of science teachers. For many years there has been criticism of the training of teachers at the universities because the particular branches of science studied by prospective teachers at the university are not adequate preparation for the science subjects taught in some schools.* Professor H. Graham Cannon has suggested [1] "that the first science degree for undergraduates should be a general science degree. It gives a student grounding in a variety of subjects and, if it is properly taught, of necessity it shows the interrelationships of those subjects, and it does not lead to that completely unintellectual isolation which results so often from the special honours degree." The present writer believes that such a degree would be the most suitable first qualification for all grammar school science teachers. The recent [2] White Paper on the Report of the Advisory Council on Scientific Policy comments on all present-day science graduates as follows: "... they tend to lack a sufficiently broad education, not only in a general sense, but also in the field of science."

Although *the inadequacy of the scientific background of the science teacher* is not the main theme of this article it is surely relevant to discuss it here, and it is a vital duty of an education department to discuss the subject with the teacher-trainees. Until more universities provide degree courses in general science of the kind suggested by Professor Cannon there would seem to be a need for the provision of supplementary science courses for graduates during their year of professional training. Those students who did not include biology in their degree studies would take a supplementary course in biology, and those who did not include physics would take a similar course in physics. Such courses are provided in many of the Commonwealth Teachers' Colleges for graduates whose scientific background is inadequate for teaching general science. There is an alternative suggestion to provide only one supplementary course in science during the professional year instead of three or four courses in the separate science subjects. As the writer can see little hope of introducing substantial supplementary science courses into students' time tables which are already full, he considers it his duty to suggest to students how they might improve their knowledge of those branches of science which they have not studied adequately either at school or university. He recommends suitable books; draws attention to syllabuses of courses provided by such bodies as the Ministry of Education, Local Education Authorities, University Extra Mural Departments, Field Study Centres and Adult Colleges to name only a few; and discusses the provision of laboratory work at technical colleges.

The third factor bearing on the question of whether to teach general science or separate science subjects in the lower forms of grammar schools is the *purpose of teaching science. The young science teacher will have to decide to what extent he is going to be engaged in producing physicists, chemists, and biologists, and what are his responsibilities towards children in helping them to identify and deal with their problems of living in a democratic and dynamic community.* With a clearly defined purpose the teacher can then choose the content of his syllabuses from a wide field of science and use teaching methods which are most suited to his pupils, the school environment, and the achievement of his aim.

Third Aim—Understanding the Nature of Science

When young science graduates enter an education department after several years of intensive scientific study they need to consider the nature of the science they have been taught and the science they are going to teach. *In the past, university and school science teaching has concentrated on purely factual information and techniques, and has paid little attention to the nature and limitations of scientific method, to the place of science in human affairs, and to the development of a scientific attitude of mind.* Perhaps lecturers and teachers of science have mistakenly assumed their students would transfer the procedures of scientific method, learnt and practised in their science courses, to

[1] *Nature*. Vol. 163, p. 882, June 4, 1949.
[2] Cmd. 8561, 15th April, 1952, paragraph 25.

other spheres of life. It is now commonly recognized, and there is some psychological evidence in support of the views, that this transfer is only slight and that transfer is achieved by teaching explicitly the principles of scientific method. *Until university science departments introduce courses in the understanding of science for their undergraduates it will be all the more necessary for a method course to have as its third aim the achievement of an understanding of the nature of science by graduates who will be teaching science during the next four decades.*

No claim can be made by the writer to having developed a novel technique of explaining the nature of science in two lecture periods per session, which is the maximum time that can be given to this part of his method course. The most he attempts is to give an analysis of the methods of science, to quote some examples of the part played by science and technology in shaping our society, and to point to various types of social action which involve the use and understanding of science. He has found it profitable to spend a short time in discussing the need for the application of scientific methods in matters of public welfare and daily living; in this connection a few articles, slogans, and advertisements in the current issues of newspapers and magazines are examined. The topics discussed last session were smoke abatement, corporal punishment, the effects of smoking, and advertisements of some patent medicines. On a more practical note, students are asked to consider a number of the "Trace the fault," "What would you do if . . .?" and "How would you tackle this?" kinds of problems which occur in every household.

Fourth Aim—Appreciating the Objectives of School Science Courses

This brings us to an important point and the fourth aim of a method course. The students have now to consider the implications of this wider view of science in terms of the specific objectives of their school science courses. The acquisition of information and techniques is the first and obvious objective of any course. This objective is the one most familiar to students who already have passed several examinations which appraised little else beyond the acquisition of facts. In general, we may recognize three further objectives of good science teaching. When facts have been acquired the second objective is to develop scientific methods of thinking, and the students need to consider a few concrete examples of how such methods may be made to apply to the teaching of the subject matter of science. The third objective is the development of the ability to generalize on the basis of learned facts, and to apply these generalizations to the conduct of daily activities. Pupils are taught that under certain circumstances milk may carry bacteria pathogenic to man. It is more important for pupils to appreciate the reasons for the treatment and careful handling of milk than to memorize the names of the causative bacteria and the categories of milk. The fourth and last desirable outcome of good science teaching is behaviour which is based on the training received. *If pupils develop an attitude of intellectual honesty, a belief in cause and effect, a habit of basing judgment on facts, and a disposition to solve problems rationally, their training will have given them something of value in meeting the challenges of the environment.*

Having decided on the objectives appropriate for his science course the student teacher should be introduced to methods of evaluating the outcome of his teaching. He will have to become familiar with the procedures employed in making satisfactory examinations which contain evidence of the degree to which he is achieving all his objectives. Investigations into the problems of testing have shown that the essay type plus the objective types of examination provide a much more effective evaluation than either of these by itself. Teacher-trainees are familiar with the essay type but not with the objective types of examination. Following a lecture dealing with this fourth aim, students are given a written exercise in which they have to show how they would achieve the four objectives outlined above when teaching chosen topics from their own branch of science, and to make tests to evaluate each objective. Sometimes a student has an opportunity to try out his teaching and evaluation plans in school practice later in the session. The chapter on Examinations in the book, *The Teaching of General Science*,[3] is useful to students for this part of the course.

Fifth Aim—Training as Experimenters in Teaching Method

The fifth and last aim of a method course to be mentioned here is that of trying to turn out *teachers who are experimenters in methods of teaching science and whose actual teaching should be a functional application of scientific method to their craft.* Experiment is the crux of scientific method. Hence as scientists, the new teachers should develop a healthy scepticism towards time-honoured practices of teaching and adopt an experimental approach as the keynote of their professional attitude to

[3] *The Teaching of General Science.* A report of the General Science Sub-Committee of the Science Masters' Association, pp. 117-122.

their work. *One might expect this aim to be achieved more easily with science graduates than with art graduates, but there is no evidence of this known to the writer.*

A lecture dealing with both the various ways of teaching the same topic and the American experiments on the relative merits of teacher-demonstrations and pupil-practical work is followed by an exercise in which students have to prepare lesson notes for teaching a given topic to a specified age group. Then the various lesson notes are compared at a discussion meeting of tutor and students. Each session a number of students write a long essay, one of two submitted as part of their Certificate examination, either on some experimental teaching they have done on school practice, or on an evaluation of the teaching methods used in a selection of school text books.

It has been assumed in this article that the preparation for science teaching is in two distinct parts, a three-year course in science followed by a one-year course of professional training. It is open to discussion whether this is the best preparation. There are at least two other forms of preparation which merit serious consideration. The first of these is to keep the degree and post-graduate courses distinct, as at present, but to plan the science content of the degree course with the purposes of teaching in mind. The second is to have a four-year or longer course combining both the content of a science degree course and the professional training.

THE SCIENCE TEACHER AND THE *Challenge of Cancer**

By MURL C. SHAWVER

Associate Professor of Biology, Madison College, Harrisonburg, Virginia

TODAY we frequently hear about science courses organized around important problems in the daily lives of youth. Written reports of such courses are appearing with increasing frequency in the periodical literature. This would seem to suggest that the search for that which is basic to effective science teaching is taking a trend which offers much promise toward an improved education for our youth.

Objective studies dealing with trends in science course organization in the secondary schools and institutions of higher learning of the United States are few in number. Martin's study of general biology is for the school year 1949-50, and is based upon usable replies from 786 or 3.7 per cent of the nation's public high schools.[1] Replies from all 786 schools, except three, suggested three types of course organization. Courses based on *principles related to the whole field of biology* numbered 599 or 76.5 per cent. In 98 schools, 12.6 per cent, the course was based on *specialized treatments of botany, zoology, and physiology*. Eighty-six schools, 10.9 per cent, reported courses based on *topics selected for their importance in daily living*. The writer believes that the last one of these three types of course organization is the most suitable for the effective study of those problems of current and common interest. Foremost among the pertinent problems of our time are those related to the control of man's major diseases.

The major health problems of our times deserve the careful attention of students and teachers of science as they seek to establish learning situations related to daily living. Mental illness, cardiovascular disorders, and cancer are currently identified as the three major health problems in this country. All three of these health problems suggest to students and teachers of science many useful learning activities. It is to the second killer of mankind—cancer—that we give our attention in this article.

Human cancer is a great enigma. In 1954 approximately 230,000 Americans died of cancer.

* The author is indebted to Robert B. Thorpe, Dr. Brewster Miller, and John Beffel of the American Cancer Society for their helpful suggestions.

[1] Martin, W. E., *The Teaching of General Biology in the Secondary Schools of the United States*. United States Office of Education, Bulletin #9, 1952.

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Cancer is one of the most curable of all the major causes of death.[2] The American Cancer Society estimates that 75,000 of the 1954 victims died needlessly from cancer because their malignancies were not discovered in time.

Cancer is not unique to the human organism. It represents a cellular disorganization in multicellular organisms. Our chief concern with cancer is with the disease as it is manifested in all of its multiplicity of effects in man himself. Cancer in domestic animals causes little or no economic loss to man because most of these animals are generally not allowed to attain old age. With few exceptions, there is a striking similarity, as to anatomical location and ultimate effects, between human cancer and malignancy in other animals. There are even examples of occupational cancer in animals. In certain areas of India, wagons are pulled by oxen which have had a rope tied around the base of the right horn. After a time cancer may develop at this particular place.[3]

In one form or another human cancer is the second most common cause of death in the United States. At the sixth International Cancer Conference held in Sao Paulo, Brazil, in July, 1954, it was stated that the number who die each year from cancer in the world is unknown. However, conservative estimates range from two million to three million cancer deaths annually in the world.[4]

Human cancer is found in all parts of the globe. No racial group is known to be free of it. But certain types of cancer are less common in particular parts of the world. Primitive populations seem to have a low cancer death rate because of the relatively few old persons in such societies, and probably because of the inadequacy of reporting on cases of the malady.

Cancer in the human family is found at all ages, in both sexes, and in those body tissues where mitosis occurs. It is extremely rare in some tissues such as heart muscle and the duodenum of the small intestine. The three most common sites for cancer in the male are the gastro-intestinal tract, respiratory system, and the prostate. In the female the breasts, uterus, and gastro-intestinal tract are the most common sites.[5]

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[2] Johnson, Dallas. *Facing the Facts About Cancer.* Public Affairs Pamphlet #38.

[3] Russ, Sidney. *Cancer. Where We Stand.* Page 35. Oxford University Press. London. 1950.

[4] Brewer, Sam Pope. "Cancer Detection," *New York Times,* July 29, 1954. Page 23.

[5] Information about cancer sites was obtained from *Statistics on Cancer,* prepared by the Statistical Research Section of the American Cancer Society.

Cancer most often appears after the age of forty. Yet it is found at all ages, and has even been observed in the new-born. Between the ages of three to fifteen it takes more children's lives than any other cause except accidents. The cancer death rate in the United States has doubled since 1900. More cancers are discovered now because vastly improved diagnostic facilities are available to the medical profession. Our population has become increasingly older. In 1900 only 23.4 per cent of our population were over forty years of age. In 1950 slightly more than 33 per cent were over forty, and in the year 2,000 it is estimated that 46.4 per cent of our population will be above that age. A conservative estimate has been made by the American Cancer Society that 17,000,000 Americans will die of cancer in the next fifty years unless the cancer death rate and/or the population trends are altered.[6]

Consequences of the inter-relationships between environmental factors and life systems provide man with some of the most complex problems of the natural world and cancer has been described as "the most difficult research problem man has ever attempted to solve."[7] Basically, it appears to be a multiple problem in cellular biochemistry. Cancer cells do not generally respond to the usual growth inhibitory factors of the organism. Unless molested, those cells continue their growth. A cancer does not "eat" healthy tissue, as some believe, but it does kill by interference with normal processes of cell metabolism. Aberrant growth patterns result in a disorganized tissue mass, known as a neoplasm or malignant tumor. Such a tumor has a deficient blood and nerve supply, which consequently causes inadequate nourishment and protection against infection at the site of growth.

Not all tumors are cancerous or malignant; certain tumors are benign. These are local growths usually surrounded by a limiting capsule which prevents cells from invading the surrounding tissue. Cancerous tumors do not remain localized, because unlike benign tumors they do not have a limiting capsule; consequently cancer cells can migrate to other parts of the body and set up secondary cancers or metastatic growths. The longer a cancer exists the more likely that extensive metastasis will occur. The blood and lymph streams carry cancer cells from the primary site to distant parts of the body. Treatment is much more difficult if metastasis has taken place, hence the great urgency for the early detection and treatment of cancer while it is still localized.

As a general rule there is no pain in the early stages of cancer.[8] Pain is a late symptom in most cancers. However, there are certain early signs of cancer which should be known by every person. These seven common danger signals are set forth in many of the American Cancer Society's publications and are constantly emphasized in its program of public education. They are:

1. Any sore that does not heal.
2. A lump or thickening in the breast or elsewhere.
3. Unusual bleeding or discharge.
4. Any change in a wart or mole.
5. Persistent indigestion or difficulty in swallowing.
6. Persistent hoarseness or cough.
7. Any change in normal habits.

Those warning signals do not necessarily mean cancer, but when they appear a doctor's advice should be sought immediately.

With respect to cancer, the urgency of getting such advice at once cannot be stressed too strongly. Regular physical check-ups are very essential; the ACS has repeatedly recommended that every member of the family should have an annual physical examination. As added protection, semi-annual pelvic check-ups for women over 35, and semi-annual chest X-rays for men over 45 are strongly recommended. Cancer detection often requires the attention of various medical experts. This is not to say that the general practitioner is to be by-passed in seeking advice about a warning signal. In most cases it is he who should be consulted first about a health problem. Final decision as to whether a condition is malignant or benign may require the services of a pathologist.

Under the microscope cancerous cells display various unorthodox cell characteristics, such as shattered chromosome fragments, a higher number of chromosomes than is characteristic of the species, distorted and deeply staining nuclei, and unequal cell division.[9] The pathologist is able to discern cancerous cells by the utilization of a variety of laboratory techniques. Tissue suspected of being cancerous is removed for microscopic examination. This is known as a biopsy. Tissue, thus removed under surgical conditions, is sent to the pathologist who may make a frozen section, stain, examine, diagnose, and report to the patient's surgeon or

[6] This estimate also supplied by the Society's Statistical Research Section.

[7] Spike, J. Edward, Jr. "Cancer Research," *Science*. Page 115, February 29, 1952.

[8] When cancer involves bone and nerve tissue, pain may be a symptom in the early stages of growth.

[9] *Ca—A Bulletin of Cancer Progress*. January, 1954. Vol. 4. American Cancer Society, Inc. New York.

family physician. Obtaining a report of biopsy material may require fifteen or twenty minutes in some hospitals. The pathologist may use the method of fixing tissue in paraffin, slice it as thinly as $\frac{1}{1000}$ of an inch, stain, and examine it under a microscope. This method generally takes 24 hours or longer before a diagnosis can be made.

There are two widely recognized ways of treating human cancer: surgery and radiation. Recent advances in these forms of treatment are now saving more lives than ever before. More extensive surgery on cancer patients is now possible as advances have been made in pre-operative and post-operative care. Other improvements in the control of cancer and the alleviation of suffering which is caused by it are found in advances in radiation therapy. New developments in electronic engineering and the production of radioactive isotopes have greatly increased the scope and methods of treatment by radiation. Some radiation therapy is now carried on with roentgen-ray beams at energies of two million volts or higher.[10]

Large scale testing of many chemicals and substances of natural origin, such as hormones, is an attempt to identify drugs effective against cancer. The search for more effective chemotherapeutic agents has been accelerated in recent months. In 1953 studies were made, at Memorial Center in New York, of 4,087 compounds and 3,050 crude preparations of natural origin.[11] The nitrogen mustards, among the most promising of the chemotherapeutic agents, bring about temporary remissions in a high percentage of patients with Hodgkin's disease, lymphatic leukemia, lymposarcoma, and a few other types of cancer. The lymphomas respond to treatment with triethylenemelamine (TEM), another chemotherapeutic agent.[12] Urethane, cortisone, and ACTH have also been used with effectiveness in bringing about significant and sometimes prolonged palliation.[13]

Human cancer now confronts science with some of the most baffling problems ever to challenge man. Multitudes of questions must be answered if we are to control this dread disease. One group of questions deals with cancer of the lung. Dr. Charles S. Cameron, Medical and Scientific Director of the American Cancer Society, has recently stated: "Cancer of the lung is showing the most rapid increase ever ascribed any non-infectious disease in medical history.[14] Mortality in American men from lung cancer has increased 500 per cent in the last twenty years.[15] The causes of this increase have not been scientifically demonstrated. But there is evidence of a definite association between heavy cigarette smoking and cancer of the lung. Other evidence associates several kinds of air pollutants with that type of disease. The American Cancer Society has undertaken a study of the smoking histories of 187,766 white men between the ages of 50 and 69. A progress report made by the director of the study, Dr. E. Cuyler Hammond, and Dr. Daniel Horn, assistant director, to the American Medical Association in June, 1954, showed that the over-all death rate for regular cigarette smokers was 52 per cent above that for men who had never smoked. Cancer and diseases of the coronary arteries accounted for most of the difference in death rates. Heavy cigarette smokers (more than one pack a day) were reported to have a mortality rate from cancer of the lung more than five times as high as that for non-smokers.

As a result of the Hammond-Horn report, the ACS, at its annual meeting in the fall of 1954, passed the following resolution:

> "Be it resolved that the American Cancer Society emphasize to the American people that the presently available evidence indicates an association between smoking, particularly cigarette smoking, and lung cancer; and to a lesser degree, other forms of cancer.
>
> Our smoking study further revealed an association between smoking and heart disease." [16]

So as progress is made in the control of human cancer we raise the question of the science teacher's role. The professional background of science teachers places them in a position of unique responsibility with regard to programs of cancer education in the school and in the community. In classroom, laboratory, and science club activities, teachers and students should formulate programs of studies leading to an intelligent awareness of human cancer and its control. Scientific progress in cancer research reveals significant vocational guidance for youth. Science teachers will find any one of the sixty divisions of the American Cancer Society willing to supply advice as to appropriate cancer literature, films, and teaching aids for use in school or college.

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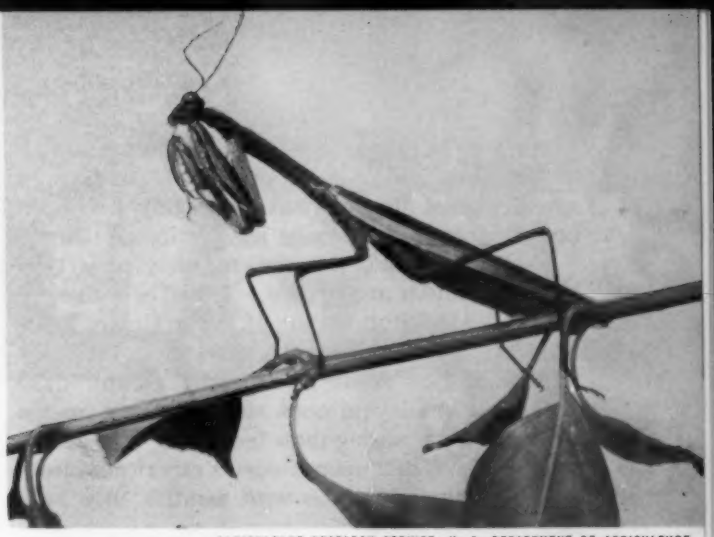
[10] *Ca.—A Bulletin of Cancer Progress.* January, 1955. Vol. 5. P. 14.
[11] *1953 Annual Report.* American Cancer Society. New York. P. 46.
[12] *Ca—A Bulletin of Cancer Progress.* March, 1953. P. 49.
[13] *Ca*—July, 1954. P. 142.
[14] *A.C.S. Bulletin,* Nov. 15, 1954.
[15] *1953 Annual Report.* American Cancer Society. P. 10.
[16] *A.C.S. Bulletin,* Nov. 15, 1954.

THE FRIENDLY INSECT

By JAMES E. RICHARDS, JR.

High School, North Bend, Oregon



AGRICULTURE RESEARCH SERVICE, U. S. DEPARTMENT OF AGRICULTURE

WOULD you like to raise some "foreign" animals in your classroom—animals which are entirely useful to mankind, unusual in appearance, and extremely interesting? Too often we have seen the effects of the unplanned introduction of many exotic species, such as the rabbit in Australia or the starling and English sparrow in the United States, and the results which followed. Here, however, we have an animal which has proved itself to be a help to mankind as its diet consists of insects and other animals. Reference is made to over 1000 species of praying mantises from the family *Mantidae*.

Living Habits

About 19 species are native to the United States, being found mainly in the southern and eastern states. Most of the species are foreign, being found generally in the tropics. Many of the varieties now found in parts of the United States have been accidentally introduced along with plants from other countries, possibly in the form of egg cases. The name "praying mantis" is derived from the animal's prayerlike stance with forelegs folded while waiting for food to pass by. When some unfortunate animal passes in front, the insect changes to preying with a rapid reflexive action as the folded legs swing out to catch and grasp the unwary victim in a powerful viselike grip. The food is then eaten alive.

This food will include almost all insects, spiders, many other animals, and even fellow mantids. This last possibility may occur in at least two situations. The first takes place when the animals are overcrowded and hungry, and the second is a product of mating. The female, which is generally somewhat larger, devours the mate as a culmination to mating. Frequently, the female will feast upon the male without mating.

When mating has been carried out, the female deposits her frothy egg mass which is about one to one and one-half inches in diameter. This is deposited upon a branch or the stalk of a weed. The froth hardens and turns brown. At the end of the season following mating, the adults become sluggish and die. This leaves the future of the species tied up in the egg cases. Adult life may be sustained in-doors for about a month longer than out-of-doors.

When these egg masses hatch in the spring, each may disgorge over a hundred young mantids. The young are light-colored upon hatching. At a glance, they appear similar to mosquitos. After a few hours of exposure to the air, they turn to light brown. The mantids are usually not hungry for 12-24 hours after emerging. Then they will start feeding on such things as fruit flies or a mixture of honey and water.

When the insect is about 10-14 days old, he will become very sluggish, as though dying. This is a most interesting time for close observation, as he will be moulting his old skin. Every portion of out-grown skin, including that covering the tiny antennae, will be discarded. After this process is completed, the animal will expand much as an opened accordion, nearly doubling in length in early moultings. This phenomenon will repeat at about the same 10-14 day interval. During these times, the animal will be lacking in physical strength and should not be handled. It is also important to keep ants away at this time as well as at hatching time as they take great pleasure in feasting upon the helpless animals. This may account for the mantids' instinctive fear of ants, one of few animals which are feared by mantids. The mantids will temporarily be light again following the moulting. As the moultings proceed,

wings will be seen to develop on the dorsal side of the body, being fully developed after six or seven moults. These wings are highly developed, but the animal relies on its legs for locomotion.

The insect makes an excellent study project for both individuals and groups. It makes a fine pet as well. Mrs. Ruth Grant of Sugar Grove, Pennsylvania, has used them in connection with Boy Scout and Girl Scout insect study groups. The activity invariably arouses strong interest in the study of insects among these teenagers. The author has found also that many students experience meaningful learning situations with mantids they raise at home.

Suggestions

Egg cases probably can be obtained from any biological supply house. Both Mrs. Grant and I have found one excellent source to be Mr. Melville W. Osborne, 2100 Price Street, Rahway, New Jersey. Orders should be placed in the winter or very early spring so that the mantids will not hatch while in transit. The egg cases may be kept out-of-doors or under refrigeration until such a time as it is desired to have them hatch. Do not allow the cases to become excessively damp.

After you have acquired the egg masses, you must give some thought to the housing and feeding that will be needed. The young animals will need plenty of small food no larger than they are. Drosophila make a fine source of early food. The Drosophila cultures should be started approximately three weeks prior to the anticipated hatch.

To start a culture of Drosophila: cook corn meal as you would for mush; place in a jar with some molasses and yeast on top; set the mixture outside for a while to attract fruit flies. These will develop into a colony capable of feeding several mantids. A piece of paper should be arranged in the jar so that the young larvae will have something to crawl up on. Use a bit of old linen for a cover, placing a small hole in the center for the removal of flies. Keep this hole plugged with a wad of cotton when not being used.

A quart jar will serve as a suitable container for a mantid or two during the early portion of their lives. Grow some grass in the bottom to simulate natural surroundings, with a stick or branch standing up in the jar. The insects will crawl up this stick at moulting time. Further, you will find that the animal is negatively geotropic; that is, it spends much of the time hanging upside down from branches. The amount of water needed to keep the grass growing will be sufficient for the mantid. As the animal grows, he can be trained to drink from a spoon. Use a cover similar to the one covering the fruit flies for the mantid jar.

The author experienced the hatching of mantids two weeks before obtaining feeding instructions. As it was early for insect hatches from the out-of-doors, feeding became a problem. A time-consuming method was discovered to work. Tiny bits of hamburg placed on toothpicks were waved in front of the animals, which proceeded to eat some of the meat.

Mention has been made of the cannibalism which occurs either after mating or when mantids are overcrowded and are forced to it by hunger. The author started out with eight young mantids in a quart jar. Three died and one of the five remaining insects devoured the other four. The mantids will eat heavily when food is available, yet they may go a few days without food when it is lacking.

Mantids seem to be able to heal broken appendages. The sole survivor mentioned above broke one leg in the process of moulting. This appeared to be completely healed following the next moult.

It might be wise to consult your State Department of Agriculture prior to introducing the insects to your state.

Here's hoping you and your students find the animals as interesting and educational as my students and I have!

Bibliography

1. Hermes, R. C., "My Friend Bertha, the Praying Mantis"; *Colliers*, 131: 50-53, May 16, 1954.
2. Roeder, K. D., "Raising the Mantis for Experimental Purposes"; *Science*, 83: 582-583, June 12, 1936.
3. Teale, Edwin Way, "Praying Mantis: Friend of Man"; *Coronet*, 30: 53-56, July, 1951.

PROCTER & GAMBLE SCHOLARSHIPS

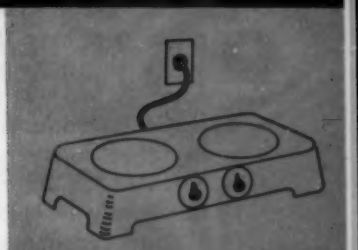
Announcement was recently made of the 46 colleges and universities in 15 states participating in two new P & G scholarship plans—Amherst, Barnard, Brown, Bryn Mawr, California Tech, Carnegie Tech, Case, Chicago, Colgate, Columbia, Cornell, Dartmouth, Davidson, De Pauw, Denison, Duke, Goucher, Harvard, Illinois Tech, Kenyon, Lehigh, Massachusetts Institute of Technology, Mills, Mt. Holyoke, Northwestern, Oberlin, Ohio Wesleyan, Pennsylvania, Pittsburgh, Princeton, Radcliffe, Randolph-Macon Women's College, Rensselaer, Smith, Southern California, Stanford, Syracuse, Tulane, Vanderbilt, Vassar, Washington, (St. Louis), Wellesley, Wells, Williams, Xavier (Cincinnati), and Yale.

These institutions will award 60 full-tuition, four-year scholarships beginning this fall. The scholarships are completely unrestricted as to course of study or future-employment, and will also provide an allowance for books and supplies.

Recipients will be selected by the participating schools on the basis of their own standards of academic achievement and student financial need. Apply directly to the registrars of the desired institutions.

Equipment for Elementary Science:

PROVIDING A SOURCE OF HEAT

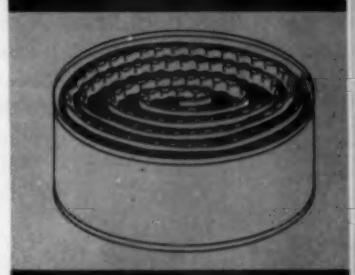


By FRANKLYN M. BRANLEY

State Teachers College, Jersey City, New Jersey

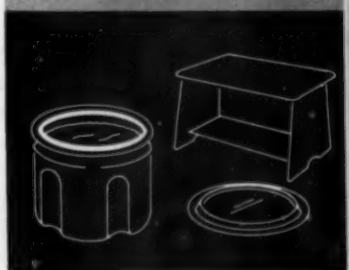
MOST ELEMENTARY SCHOOLS are not equipped to teach elementary science. This is the way it should be—if and when the equipment is provided in any of the following ways:

1. If the science room is a communal place where there is a collection of equipment to be used by a particular class during a preassigned period. A museum is fine to supplement a dynamic science program but it certainly cannot replace such a program.
2. If the science equipment is placed upon a wagon that is wheeled from room to room in a preassigned manner.
3. If the science equipment takes the form of that which is usually used in a secondary school laboratory. There is a place and a need for certain pieces of technical equipment in the elementary school; but these needs are most limited. Complicated exhaust pumps, intricate distillation set-ups, complex soil testing equipment, and the like serve only to confuse elementary school youngsters and their teachers.



The best equipment for teaching elementary school science is the teacher. We are in great need of men and women who are alert to the science needs of young children and who have the vitality, academic integrity, courage, and spirit of adventure that will enable them to go ahead with science experiences.

This writer questions the value of lists of equipment for teaching science in the elementary school. For, as a matter of fact, if one were to list the materials used in an active classroom where science is recognized and where both the teacher and the pupils have learned how fascinating this subject can be, that list would be endless. An active group of young people will use all the resources of their homes, their garages, the school, and the community in their study of science.



However, it does help in organization if a part of the classroom is set aside for the storage of equipment as it is gathered (and used), and for the placing of reference materials, as well as certain articles, that are used over and over again. For this purpose a corner of the room should be so designated. In its simplest form this solution might be nothing more elaborate than a couple of wooden crates that are used to store objects and the tops of which are used for display purposes. This can become more elaborate and ambitious as time and money permit. No matter how much money is spent, it is advisable to have open shelves rather than closed ones. Doors are frequently hazardous in the classroom; in addition, they undermine the freedom to observe and to use. The science materials belong to the children and are

meant for their use; therefore, there is no need to close them off or to lock them up.

The problem of providing adequate heat occurs often. Many experiments and problems that children desire to work out call for heat. The following suggestions are given in the hope they will prove helpful.

The simplest and safest heating device is an electric hot plate. There is no open flame. Many hot plates now have thermostatic shut-offs which turn off the electricity automatically should the coils become too hot. If purchasing a hot plate, a double one is recommended; also, look for one with enclosed heating elements rather than the type in which the heating coils are exposed. Look for Underwriters' Laboratory label of approval.

Often, adequate heat can be secured with an ordinary candle; however, there are drawbacks. A candle will blacken whatever is held in the flame. Also, the amount of heat given off is so small that it requires a rather long time to bring even a small amount of water to a boil.

However, a candle can be used more efficiently by placing it in a tin can that has been prepared as follows: Remove the cover from a can and then punch half a dozen holes around the sides near the bottom, using a punch type can opener. Stand a candle in the bottom of this can. When the candle is lighted, the heat produced will be concentrated by the can; also, the candle will burn freely because the holes at the bottom of the can provide an excellent draft. The can may be used as a stove. Anything to be heated can be placed directly on the top of it.

Another type of modified candle is the so-called "buddy burner." It produces a large amount of heat and burns for a relatively long time. To make it, spiral a length of corrugated cardboard inside an empty, low-form tuna fish can from which the top has been removed. The cardboard strip should be about a foot long and as wide as the can is high. When the cardboard is in position, melt old candles and pour the wax into the can. When the wax has hardened, ignite the cardboard. All parts of the spiral will burn at the same time and so a large amount of heat is produced. If this burner is put inside another can with holes punched in it as directed above, the heat produced is quite astounding.

Canned, jellied alcohol (usually sold under the trade name of Sterno) is an efficient and safe source of heat in the classroom. For less than a dollar one can buy a can or two of this material as well as a metal form that can be used as a stove. Canned (solid) alcohol is safe to use because alcohol fumes will not explode, and because the flame can be extinguished simply by placing the lid of the can in position.

An alcohol burner that uses liquid alcohol and which gives a rather good supply of heat can be made very easily. All that you need is an ink bottle, a cork that fits the neck, and a piece of wicking. Bore a hole through the cork with a drill bit, or heat a nail and burn a hole through the cork. (Do not try to pick your way through it with a nail, piece of wire, or a bobby pin, for this will result in failure.) If you have a cork borer, that will work best of all. When you have made the hole through the cork, push a piece of wicking through the opening. (Wicking may be obtained at the neighborhood hardware store.) About one-quarter inch of wicking should extend above the top of the cork; the rest of the wick will rest inside the bottle. Place the cork in the bottle after having filled it about half-full of alcohol. Use ordinary rubbing alcohol or alcohol type of antifreeze.

When the wick has soaked up sufficient alcohol, light the wick and you will have a blue, hot flame that is relatively free of carbon.

If you can afford it, the best source of heat is a liquefied petroleum gas burner. This burner is available from a number of supply houses (see TST ads). It costs $7.95. To use it, you need a burner tip and a stand. These burners are about 18 inches long; they are portable and provide a very hot flame—similar to the flame you get on the burners of a gas range. A single tank of gas (which is supplied and included in the price of the burner) will burn for about ten hours. This is more than enough time to provide for the needs of several classrooms for an entire year. Refills for the burner cost about two dollars.

As can be seen from the above suggestions, the heat problem can be solved in many ways. In elementary science, problem solving is of paramount importance. Here is a real problem that teachers and pupils can work out together.

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Science Education 1955 . . .

A DIRECTORY of SUMMER WORKSHOPS and PROGRAMS of STUDY

This directory is included as a protessional service to teachers of science in elementary schools, high schools, and colleges, and to the institutions listed. The brief descriptions (paid announcements) give the name and location of the institution; the name, title, and address of the person to contact for further information; and special features of the undergraduate and graduate program in science education, and of workshops, special courses, and other offerings scheduled for the summer of 1955. Please mention *The Science Teacher* when you write to any of these institutions. We will continue to include this feature on an annual basis if you find it helpful. *Editor.*

CALIFORNIA

WEST COAST NATURE SCHOOL, SAN JOSE STATE COLLEGE, San Jose. Gertrude Cavins, Registrar and Secretary. Outdoor field school with college credit. Three one-week sessions in outstanding California recreational areas: June 19-25, Sequoia National Park; June 26-July 2, Fallen Leaf Lake; July 3-9, Cambria Pines. Two quarter-units of college credit for each six-day session. Outstanding field instructors cover such areas as: wildflowers, geology, birds, insects, trees, mammals, and other outstanding features of the area. Variety of living accommodations available.

CONNECTICUT

WESLEYAN UNIVERSITY, Middletown. Joseph S. Daltry, Director of Teacher Services. Teachers who wish to broaden their education may begin the study of new subjects, e.g., biologists may take elementary courses in chemistry or physics for graduate credit. Curriculum includes advanced courses dealing with recent advances in *chemistry* (antibiotics, synthetic macromolecules, instrumental methods) and *biology* (isotopes, photosynthesis, energy metabolism); also *mathematics* (higher plane curves, projective geometry) and *organic chemistry*. All the above plus courses outside the field of science (history, literature, philosophy, etc.) may count toward the Master's degree or the Certificate of Advanced Study—30 hours beyond the Master's degree.

MAINE

UNIVERSITY OF MAINE, Orono. Mark R. Shibles, Dean, School of Education. Varied undergraduate and graduate offerings in biology, chemistry, and physics for teachers: *Workshop in Conservation Education* involving laboratory and field studies under specialized consultants—3 weeks, 3 credits; *Teaching Science in the Secondary School*—3 credits; and *Seminar in Science (Educ.)*—2 credits. Any of these offerings taken for graduate credit can be applied toward the M. Ed. degree. All professional study for the degree may be related to science education. No thesis required for the professional degree.

MASSACHUSETTS

BOSTON UNIVERSITY, Boston. Robert W. Sherburne, Director, Summer Term, 685 Commonwealth Avenue. *Workshop in Elementary Science (Grades 1-8)*, July 13-29. Emphasizing subject areas of weather, nearby living things, soils, and seasons. Will include several field trips; demonstrations with two grade groups of children (Grades 1-3 and 4-6); museum-type teaching projects; and photography. Graduate credit—2 or 3 semester hours. *The Teaching of Science in Secondary Schools*, July 11-August 20. Methods course including lectures, discussions, and reports on problems connected with science instruction in junior and senior high schools. Designed for those now teaching or those who have taught general science, biology, chemistry, or physical science.

(Opportunities for High School Students)

BRANDEIS UNIVERSITY, Waltham 54. C. Ruggles Smith, Director of Admissions. Several Brandeis National Scholarships with stipends up to $1500 per year will be awarded to exceptionally qualified high school students in each of the following areas: Science, Social Science, Humanities, and Fine Arts. Scholarships are awarded primarily for merit, not financial need. Other scholarships are available for students in need of financial assistance.

HARVARD UNIVERSITY, Cambridge. W. Y. Elliott, Director, Harvard Summer School, 2 Weld Hall, Cambridge 38. Courses for secondary school teachers (fellowships available): *Recent Developments in Physical Science*—Interrelations between contemporary developments in science and technology, relations of recent scientific advances to basic discoveries and fundamental concepts; *Classroom Use of Recent Developments in Science*—Laboratory and project work, demonstrations, field trips, films, available literature, preparation of

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tests; *Materials and Methods in the Teaching of Botany* —Collection and treatment of plant material for classroom study, present systems of classification, recent trends in botanical study. Course for elementary school teachers: *Science in the Elementary School.*

MICHIGAN

MICHIGAN STATE COLLEGE, East Lansing. Dean, School of Education. *Methods and Materials for Science Teachers:* For elementary level—5 quarter-hours undergraduate credit; For secondary level—3 quarter-hours of graduate and undergraduate credit. Four quarter-hours in directed teaching at elementary or secondary levels also available. W. K. Kellogg Gull Lake Biological Station, Battle Creek, Mich. *Methods in Teaching Science.* Three quarter-hours plus variable credit in Seminar in Science Education. Six or nine weeks, beginning June 23.

MISSOURI

ST. LOUIS UNIVERSITY, St. Louis. T. A. Ashford, Professor of Chemistry and Director of Institute for Teaching Chemistry. Specially designed program for Master's degree in teaching of chemistry. Summer session, June 21-July 29, also open to non-degree students. Courses: *Seminar in Teaching Chemistry*—Teaching problems, lectures by nationally known lecturers, and visits to industrial and scientific research laboratories; *Special Topics in Chemistry; Review of General Chemistry from Advanced Standpoint; Elementary Physics from Advanced Standpoint.* Additional offerings in chemistry, physics, mathematics, geology, education, and statistics departments. Twelve $280 summer fellowships and two $1650 year fellowships available.

NEW JERSEY

MONTCLAIR STATE TEACHERS COLLEGE, Upper Montclair. Rufus D. Reed, Chairman, Science Department. *Biology*—Biological techniques, lectures, laboratory and field work; graduate credit, 4 semester hours. *Teaching Chemistry*—Trends, methods of presentation, courses of study, lesson planning, instructional aids; graduate credit, 3 semester hours. *Industrial Chemistry, Part I*—Survey of chemical plants by lecture, reports, and plant visitation; emphasis on unit operations and quality control; graduate credit, 2 semester hours. *Elementary School Science*—Development of methods and materials, using community resources; graduate credit, 2 semester hours.

NEW JERSEY STATE SCHOOL OF CONSERVATION, Stokes State Forest, Branchville. Edward J. Ambry, Director, Upper Montclair. Summer session courses in Conservation and Field Science. Visiting specialists, field trips, and extensive use of films. Many of the courses are approved for elementary certification. 1955 offerings, June 16-August 23: *Conservation Education, Rural Sociology, Camping Education, Field Biology, Arts and Crafts With Native Materials, Water Safety and First Aid, Field Science and Conservation,*

Social Studies and Conservation, Field Science for Elementary Teachers, Conservation of Basic Industrial Materials.

RUTGERS UNIVERSITY, New Brunswick. Charles H. Stevens, Director of the Summer Session. *Summer Institute,* July 6-15. Elementary and secondary teachers will participate in study-discussion groups led by outstanding science educators, hear and discuss science lectures by authorities in subject matter areas, take field and industrial trips, and engage in practical laboratory experiences. The Institute, dedicated to the examination of effective practices in elementary and secondary science programs, will provide an opportunity to live and work with alert teachers in a congenial atmosphere. Two semester hours of graduate credit may be earned.

NEW YORK

BUFFALO STATE TEACHERS COLLEGE, Buffalo 22. John Urban, Director, Science Camp. *Science Camp,* August 14-26. Field work in beautiful, heavily wooded, cool, mountainous Allegany State Park. For elementary and junior high school teachers and administrators. Graduate or undergraduate credit. Instruction directed for usefulness in classroom. Learning to identify wild flowers, trees, ferns, mosses, birds, insects, etc.; study of living things in their natural habitats; rocks, rock layers, and fossils; astronomy, meteorology, and conservation aspects. Teaching staff of three, each with public school experience. Group living in small rustic cabins; time and facilities for recreation.

CORNELL UNIVERSITY, Ithaca. Lloyd Elliott, Director of Summer Session, or Philip G. Johnson, Director of Science Education. More than 200 courses including 50 science courses and 7 related to the teaching of science. A special *du Pont Fellowship Program* carrying free tuition and some funds for expenses. A special conference together with clinics and courses on reading problems. Courses for science teachers include: *Elementary School Science, Field Natural History, Photography for Teachers, Nature Literature, Audio-Visual Methods,* a *Workshop in the Teaching of Astronomy, and Laboratory Methods in Biology.* Science courses include such areas as astronomy, bacteriology, biology, botany, conservation, chemistry and biochemistry, physics, and zoology. Beautiful and cool recreation areas are abundant.

SCHOOL OF EDUCATION, NEW YORK UNIVERSITY, New York 3. J. Darrell Barnard, Chairman, Department of Science Education. The Department of Science Education offers for the 1955 Summer Session a variety of courses designed to meet the needs of in-service teachers for professional work in the teaching of science, and for field experiences which relate science to the problems of people. Included in the offerings are workshops in: *Science Experiences in the Elementary School, Atomic Energy and Its Social Implications, Biology in Modern Civilization,* and *Conservation.* The Conservation Workshop will be held at the University Sebago Camp, August 15-26.

SYRACUSE UNIVERSITY, Syracuse. Alfred T. Collette, Dual Professor of Science and Education. Courses of special interest to science teachers offered during the summer of 1955, July 5-August 15, include: *Demonstration and Laboratory Experiments in Physics for Science Teachers, Methods in the Teaching of Science, Workshops in Science Education for Elementary and Secondary School Teachers.* A conference for high school chemistry teachers will be held for a six-week period in conjunction with a chemistry institute for college chemistry teachers. Funds may be available in the form of fellowships for tuition, and room and board. Teachers may register for 6 credit hours when participating in the Chemistry Conference.

TEACHERS COLLEGE, COLUMBIA UNIVERSITY, New York. Hubert M. Evans, Box 86. *Regional-Community Science Workshop* for elementary and secondary school teachers, principals, and supervisors. Workshop activities centered on first-hand exploration and study of plant and animal life, forests, lakes and streams, mineral resources, geological features, farming, and local industries. Ample laboratory facilities available. Emphasis placed on development of teaching materials.

NORTH CAROLINA

DUKE UNIVERSITY, Durham. Paul A. Clyde, Director of Summer Session. July 25-29. *Laboratory Conference for Teachers of Science and Mathematics* for junior-senior high school teachers; field trips, laboratory work, demonstrations, lectures, and panel discussions. June 14-July 23. *The Teaching of High School Science;* graduate credit, six semester hours; deals with such topics as aims, tests, curriculum, classroom and laboratory procedure, and field trips for secondary school science. July 26-August 31. *The Teaching of Science in the Elementary School;* graduate credit, six semester hours; deals with aims, curriculum materials, classroom procedures, field trips, and grade placement for elementary school science teaching.

OHIO

THE OHIO STATE UNIVERSITY, Columbus. H. P. Fawcett, Chairman, Department of Education. Twelve *du Pont Fellowships* for summer quarter and two for academic year; fellows divide studies between academic and professional fields, science or mathematics. M.A. and Ph.D. programs in science education; courses and seminars in curriculum, methods, supervision, and laboratory practicum; academic and professional areas. Three-week workshop, *Recent Advances in Science for Teachers.* Academic and professional seminars; field trip to Argonne National Laboratory, Museum of Science and Industry, Stone Laboratory of Hydrobiology. For elementary teachers; secondary school science, mathematics, social studies teachers, and others; and college teachers.

Here are Two Books Worth Your Attention

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While giving large space to recent developments in electronics and nuclear physics, this book pays full attention to all the fundamental principles of physics—mechanics, heat, electricity, wave motion, sound and light. Its presentation is clear and interesting and profusely illustrated. Reviews, problems and tests drive home its teachings.

BIOLOGY IN DAILY LIFE

by Curtis-Urban

The biological principles and terms that everyone should know are clearly marked in this text, so the student knows what he should learn. The style is interesting, the explanations clear, and all the handsome illustrations do a teaching job. Check-tests, activities and projects follow each chapter.

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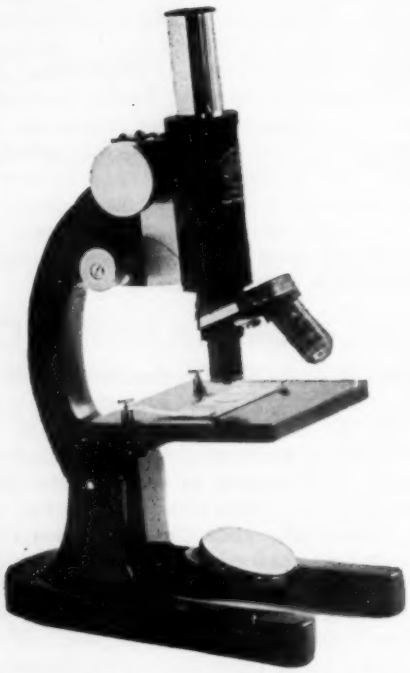

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PENNSYLVANIA

CARNEGIE INSTITUTE OF TECHNOLOGY, Pittsburgh 13. J. M. Daniels, Director of Summer Session. *Workshop for Teachers of Science,* June 27-August 5. Open to teachers of science in secondary schools who meet special requirements and are granted a fellowship. *GC-550. Workshop in the Teaching of Physical Sciences;* an integrated program of lectures and informal discussions emphasizing the power of fundamentals in teaching and learning chemistry, physics, and mathematics. Program includes a survey of recent advances in the pure and applied sciences. Eighteen units (6 credits).

OUR ERROR: The Westinghouse Summer Fellowship Program for June 27-August 5 was listed in the February, 1955 issue of *TST*, page 55, for the Case Institute of Technology. It will be held at the Carnegie Institute of Technology; Dr. Hoover, Associate Professor of Mathematics, is in charge of the program.

UNIVERSITY OF PENNSYLVANIA, Philadelphia. Philip S. Jacob, Director, Summer School. *Field Methods in Biology*—Field trips survey and measure representative plant and animal communities with emphasis on the use of scientific methods by teachers; supplementary seminars and lectures. Four semester credits. *Woody Plant Materials*—Identification and use in horticulture, landscape architecture, etc. of important native trees, shrubs, and woody vines; conducted at the Morris Arboretum, famous for 170 acres of woody ornamentals. Four to six semester credits. *The Teaching of Science*—Methods course; may be combined with one of the above content courses.

UNIVERSITY OF PITTSBURGH, Pittsburgh. Vernon C. Lingren, Associate Professor of Education. *Science Education Workshop,* July 5-August 12. Course is listed as "Special Problems in Science Teaching"; graduate or non-degree students may enroll for four or six credits. Program is designed for experienced elementary and secondary school teachers who desire to work on special problems relative to science teaching in their own schools. Registration, June 30 and July 1.

SOUTH CAROLINA

CLEMSON COLLEGE, Clemson. W. H. Washington, Dean, School of Education. Six-Weeks Courses, June 14-July 23: *Teaching of Science in Elementary Schools, Introduction to Modern Physics, Techniques of Teaching in High School, Ceramic Arts, Audio-Visual Aids in Elementary Education, Industrial Arts, Advanced Methods of Teaching Farm Mechanics, Surveying, Health Education,* many others in professional education. Regular college courses for nine weeks—agriculture, chemistry, engineering, textiles, and Arts and Sciences Schools. Special Three-Weeks Courses: May 23-June 11, *Methods in Conservation Education;* June 13-July 2, *Introduction to Education for the Exceptional Child.* Agricultural and Engineering Experiment Stations provide opportunities for research. Strong science departments—botany, bacteriology, chemistry, entomology, physics, zoology. Graduate program to Master of Science may include major or minor in science or in education.

TENNESSEE

OAK RIDGE INSTITUTE OF NUCLEAR STUDIES, Oak Ridge. Ralph T. Overman, Chairman, Special Training Division. The summer institute will present an up-to-date, comprehensive review of scientific developments, classical and modern, stressing that science should be taught and learned as a whole, rather than as a series of highly specialized and unrelated technologies. Limited stipends available; no graduate credit. Topics covered include: *Fundamentals of Physical Science, Experiments in High School Science, Radioisotope Techniques, High School Science and Related Fields, Frontiers of Physical Science, Techniques in Teaching Science.*

TEXAS

UNIVERSITY OF TEXAS, Austin. Theodore W. Munch. Summer Session, 1st Term: *Science Practicum in New Methods and Materials for the Secondary School;* graduate credit, 3 semester hours. Lectures by science personnel of the University, and industrial scientists concerning recent discoveries in the fields of synthetics, nucleonics, genetics, weather, and other sciences. Laboratory time in which to work out new demonstrations and experiments on the secondary level; study of science education problems as raised by science teachers. Summer Session, 2nd Term: *Methods and Materials for Teaching Biology.*

VERMONT

UNIVERSITY OF VERMONT, Burlington. L. S. Rowell, Director, Summer Session. *Conservation;* graduate credit, six semester hours. Lectures and field trips with over thirty visiting specialists in conservation practices, including plant, soil, water, animal, and mineral resources. Also offered this summer: *Science Methods; Science for Elementary Teachers; History of Arithmetic; Fundamental Concepts of Mathematics;* and beginning courses in botany, chemistry, geology, zoology, and animal ecology.

WASHINGTON

CENTRAL WASHINGTON COLLEGE OF EDUCATION, Ellensburg. J. Wesley Crum, Dean of Instruction. Post-session *Conservation and Outdoor Education Workshop,* August 14-August 20; upper-division or graduate credit, 2½ quarter-hours. Field trips, individual and group projects, lectures, and demonstrations conducted with the cooperation of several school districts, various governmental agencies, related industries, and interested voluntary organizations. Also offered this summer: June 13-August 12, *science* and *mathematics* methods at both elementary and secondary levels; *Science Education Workshop;* and various content courses in science and mathematics.

FINDING ATOMIC WEIGHTS

By G. W. Thiessen

Department of Chemistry, Monmouth College, Illinois

BECAUSE general or physical chemistry texts usually leave derivation of atomic weights incompletely explained, a summary of its fundamental processes is here offered in a form adaptable to beginning students.

Let the gaseous elements hydrogen, chlorine, and oxygen be (a) discovered, (b) purified until properties are constant, and (c) proved stable (to energy in subnuclear concentrations). Their elementary nature is thus established.

Synthesize hydrogen chloride and water, thus proving their elementary composition.

Do Gay-Lussac experiments[1] on combination by volume, in which it is found that: (a) one volume of hydrogen reacts with one volume of chlorine to form two volumes of hydrogen chloride; (b) one volume of oxygen reacts with two of hydrogen to form two of water. All volumes are at uniform temperature and pressures ("utp"), chosen to keep reactants and products gaseous.

Assume Avogadro's hypothesis. By it, equal volumes of different gases ("utp"), possess the same number of molecules. Assume hydrogen's valence to be 1.000....

The two experiments are interpreted by these assumptions. Tabulating:

	Hydrogen	Chlorine	Compound	Oxygen	Hydrogen	Compound
(a) volumes (experimental)	1	1	2	1	2	2
(b) molecules (Avogadro)	n	n	2n	n′	2n′	2n′
(c) molecules (proportion)	1	1	2	1	2	2
(d) molecules (proportion)	1/2	1/2	1	1/2	1	1
(e) atoms	1	1		1	2	
(f) deduction	H_2	Cl_2		O_2		
(g) deduction		Cl–		–O–		

(a) States the two experimental results. (b) Applies Avogadro's hypothesis, assuming some arbitrary number of molecules (n, n′ in smaller initial volumes taken). (c) Scales the continued ratio down by dividing each term by n or n′; it shows that proportions by volumes equal proportions by molecules. (d) Scales down further similarly so that only one molecule of compound is discussed. (f) Precedes (e) and translates the existence of a half-molecule in (d) to the existence of the diatomic molecule of an element. The distinction between molecule and atom was a stumbling block to early chemists, and confused the finding of atomic weights. Note that if one volume of hydrogen, oxygen, or chlorine should ever form 3 volumes of gaseous compound ("utp"), six-atom formulas would be required for the elements; but no more than two volumes have ever come, and therefore the diatomic formulas suffice. (e) Translates molecules to atoms in the light of (f), showing how many atoms of each element combine with the others in the two experiments. (g) Is written from the assumption that hydrogen's valence is unity; since a whole atom of chlorine, or a half-atom of oxygen, can combine with a hydrogen, each must contain one valence; and valences for the two whole atoms for this reaction must be as shown.

Consolidate distinctions between molecules, and atoms (fractional parts of molecules) and equivalents (fractional parts of atoms).

(a) Oxygen's atom[2] is now assumed to weigh exactly 16.000.... tiny arbitrary units. (b) From

[1] Consult general chemistry texts and lecture demonstration manuals for details.

[2] An atom having mean mass of that of all isotopes is measured here, and below.

this, and results in E, its molecule is found to weigh 32.000...., and its equivalent 8.000.... such, exactly.

Now find equivalent weights. (a) Measure the weight of hydrogen combining with 8.00 units of weight of oxygen, measured by experiments conducted on the gram scale but translated to the submicroscopic atomic-weight scale. The result is the equivalent weight of hydrogen, 1.008. (b) Similarly, the equivalent weight of chlorine is found from the amount of it combining with 1.008 units weight of hydrogen, as 35.5.

Assign atomic weights and molecular weights to hydrogen and chlorine. The atomic weights equal the equivalent weights because both valences are unity, hence 1.008 and 35.5, respectively; the molecular weights are twice the atomic weights because the molecules are diatomic, hence 2.02 and 71.0 respectively. All these weights depend only on weighings which may be done almost exactly, and valences and atomicities which must be integral. They are therefore very accurate.

Devise moles—gram-moles especially, also gram-atoms and gram-equivalents. (Ton-moles, pound-moles, ounce-moles and others may be devised; ounce-moles are very useful to chemical engineers.) The concept is easiest approached backward. Imagine a hydrogen molecule, weighing 2.0 units in round numbers, and an oxygen molecule weighing 32.0. Here are equal numbers (one of each) of molecules, and unequal weights. Now take two, then a million, of each. Still it is true that there are equal numbers of each kind, but unequal weights; and the weights are unequal in proportion as the weights of the molecules are unequal. Now say the same idea backward: take weights *un*equal, in ratio as the weights of the molecules are unequal, and you take equal numbers of molecules. If you take the number of grams (or ounces or pounds or tons) in every case numerically equal to the molecular weight, you are taking unequal weights in the right proportion, as simply as can be imagined. Thus, 32.0 grams of oxygen, 2.02 grams of hydrogen, and 71.0 grams of chlorine make a gram-mole of each. (Gram-atoms are 16.00, 1.008, and 35.46 grams respectively; gram-equivalents are 8.00, 1.008, and 35.46 grams respectively.)

Define the standard state by ice-point temperature and a standard atmosphere of pressure. Find the gram-molecular volume at this standard temperature and pressure ("stp") for 32.0 grams of oxygen as 22.4 liters. Check with 2.02 grams of hydrogen and 71.0 grams of chlorine. Checks are close, but not perfect; this shows that Avogadro's hypothesis is only a good first-order approximation. (The ounce-mole "stp" is 22.4 cu. ft.)

Find the molecular weights of various gaseous elements and compounds from the weight of 22.4 liters ("stp"). (Consult references for details.)

Use soluble substances of now-known molecular weight to discover laws of molal freezing and boiling-point change. (See texts for details.)

Find the equivalent weights of other elements by finding the amount for each capable of combining with an equivalent weight of oxygen or some element whose equivalent weight has been found by reference to oxygen, previously.

Note that unless element and compound are gasifiable, valence cannot be found as indicated above. Note that therefore atomic weights cannot be calculated from equivalent weights for the non-gasifiable elements at this stage. For such elements, prepare all possible gasifiable or soluble compounds, and find their molecular weights. Analyze each for percentage of the element and multiply by the molecular weight. The result is the weight of all the atoms of the element in any molecule. The least difference between such weights is the weight of an atom, and should therefore likely appear also as the smallest weight. Results are approximate, because the 22.4 liter relationship varies.

Discover Dulong and Petit's law, that for most solid elements, specific heat times atomic weights (atomic heat capacity at constant pressure) approximates a constant 6.4. Then use this to discover approximate atomic weights for new solid elements.

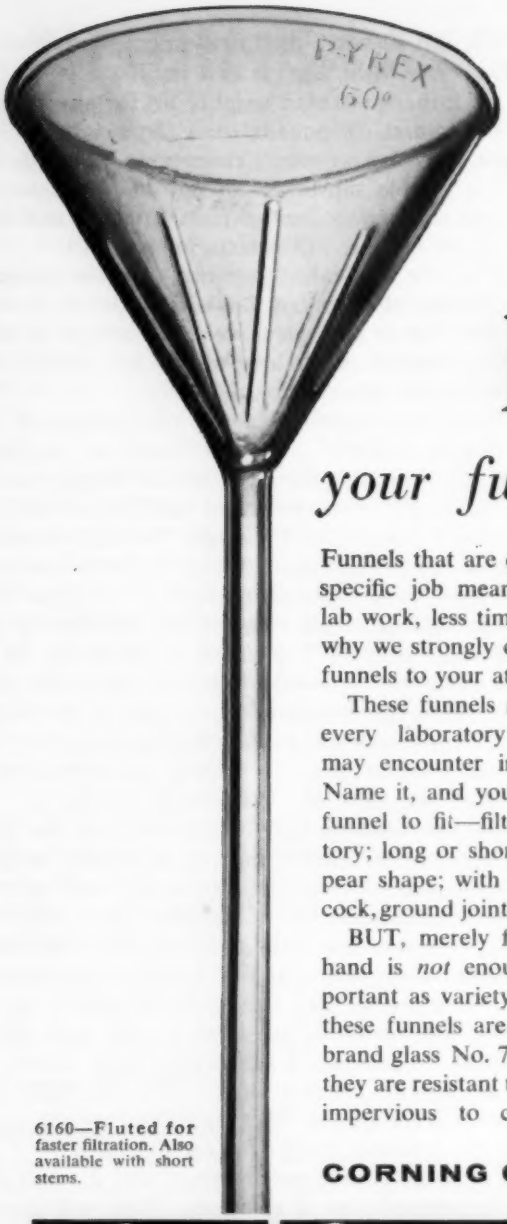
Given approximate atomic weights from methods discussed above, and equivalent weights from N, divide the former by the latter to get approximate valence. Then round the approximate valence to its necessarily integral value. Then multiply this exact valence by the exact equivalent weight to get the exact atomic weight for each element.

Calibrate a mass spectrometer and discover isotopic compositions of elements. This will involve finding electronic charge, Faraday's constant, and Avogadro's number, as well as mean atomic weights by classical means. Details do not belong in this discussion.

The inert gases likewise require an extension of the above ideas, beyond the scope of this paper.

ACS Division of Chemical Education

Announcement is made by the Examinations Committee of two new tests to be featured in the national college testing program. For information about and copies of the tests—Physical Chemistry (Form L) and General Chemistry (Form K), write to Dr. Theo A. Ashford, *Chairman*, St. Louis University, St. Louis 4, Mo.



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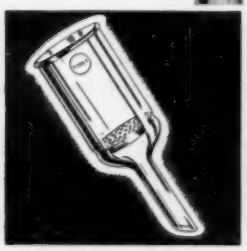
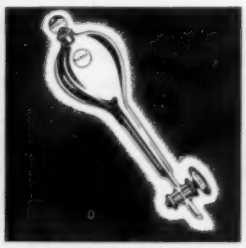


6060 — Buchner — glass body for visibility in cleaning and filtering.



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Classroom Ideas

More, more, more! This month's "Classroom Ideas" are a beautiful illustration of the kinds of "gadgety ideas" our readers want. What is your best idea along this line? Won't you share it with others? If each NSTA member would contribute one such paper only every third year, we'd be swamped. How about sending in your contribution before school closes this spring? *Editor.*

Chemistry

"Cash In" on Your Waste Platinum

By WILLIAM BARISH, Frankford High School, Philadelphia, Pennsylvania

An expensive item in the budget of a high school chemistry laboratory is platinum wire. (Latest price charged by the Warehouse of the Philadelphia Board of Education to its schools was 28 cents per inch.) In our chemistry laboratory at Frankford High School, we are extremely careful about distributing and collecting the wire. Pupils are instructed to turn in all broken pieces. These are carefully saved, along with broken electrodes. When enough scrap has been collected, it is taken to a dealer in precious metals and traded in either for cash or more platinum wire.

This may sound like petty economy, but the latest deal (made last summer) netted us three feet of free platium wire ($10.08 worth), and permitted us to order other needed equipment on our requisition. It represented about five years' accumulation.

Elementary Science

Ideas for a Young Naturalist

By GEORGE S. BARR, Science Consultant for Brooklyn, New York City Public Schools

The summer vacation gives an eager youngster the opportunity to learn about Nature first hand. Here are some suggestions for activities which are both enjoyable and profitable.

1. How far can a grasshopper or toad jump? Measure a few jumps. Are they always the same? Get the average distance. Measure the grasshopper. How many times his length does he jump? Ask your druggist to weigh him too. If you could jump like a grasshopper how far would you jump according to your height? Also according to your weight? Does a grasshopper one-half inch long jump half as far as another one that is one inch long? Do all grasshoppers that are the same size jump the same distance? How high does a grasshopper jump? What makes him jump faster—prodding or a loud noise? Am I getting too nosey? Just scientifically curious, that's all!

2. Catch a few dozen fireflies (lightning bugs). It's easy. Keep them in a jar with a pierced cover. Can you read a newspaper in the dark by their light? Shine a flashlight under the jar at different intervals from one to four seconds apart. See if you can make the fireflies light up in answer to your flashings. It can be done.

3. Find an ant, salamander, or turtle that is walking. Measure a distance. Calculate how fast the creature is traveling in miles per hour. Do ants travel up a tree as fast as on level ground? I wonder——! Follow an ant. Does it take a straight path? Does it know where it is going? Pick it up. Put it where it was a short distance before. Does it go back to the same place?

4. Watch a flower bud open. Tie a tag to it. Date it. How long until the last petal falls off? Keep records of the ripening ovary until it becomes a seed pod or fruit. How long does a day lily last? What makes a flower last longer—rain, heat, dryness, coolness? Let's do research!

5. We know green leaves need sunshine but does the flower need sun also? Use two flowers that opened at about the same time. Cover one with a large dark bag so that the flower is not injured. Leave the end loose so air can get in. Examine the flower from time to time and compare it with the uncovered one. Can you think of other experiments?

6. Punch a small log full of nail holes. Rub peanut butter into holes and hang the log from a branch on a tree in a quiet spot away from people. See how many species of birds you can attract. Birds also come to dripping water and take baths. If there is any shrub nearby the bird will sit and dry itself. You stay hidden.

7. Locate a bird's nest. Do not touch it if there are any eggs or babies. Keep notes from day to day on what is happening. How long does it take for the eggs to hatch? Does mama or papa feed the young? When did the young get feathers? When did they take their first flight, etc.?

8. Get inexpensive guide books for birds, flowers, trees, bugs, butterflies, lizards, and stars. Keep a record throughout the summer. Consider the day wasted if you do not learn one new thing before you close your eyes. It's easy! The world is so full of things!

9. Grow a plant that propagates by means of cuttings. Coleus is colorful and very easy to grow. As soon as the growth permits you to do so, snip off a growing tip and stick it into the soil. Water it carefully. Shade it for about a week so it will not dry out. See how big a patch you can have at the end of the summer.

10. Collect many different pieces of rocks. Compare with samples in museums or school, or ask somebody who knows rocks. Label them.

Get a friend to accompany you on these adventures. Don't expect to learn everything in one day. Remember a journey of a thousand miles begins with a single step. Happy Summer!

Physics

Demonstrating the Principle of Relative Motion

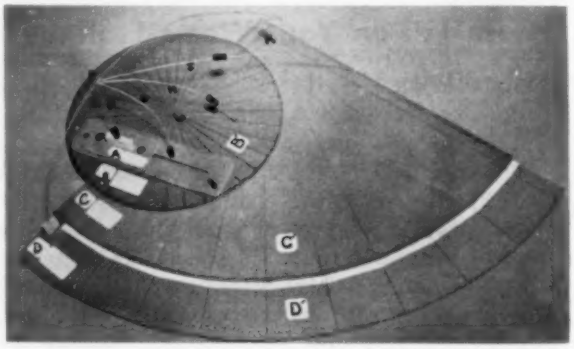
By ROBERT H. LONG, Green Mountain Junior College, Poultney, Vermont

We have found that blackboard diagrams have inherent limitations in using them to explain the principle of relative motion to science students. We have devised an apparatus, as shown in the photograph, to give a simple three-dimensional meaning to the concept. It also brings into play the actual motions in reference to certain selected points or stations.

The apparatus was designed to show the *observed* paths of a body falling under the influence of gravity, during a single "fall," and as seen from the several stations. While the "event" is supposed to involve the earth and its simple motions, the parts were not drawn to scale. Straight line and circular motion were used in place of more complicated courses so as to keep construction easy and readily reproducible by students. The simple construction does not distract from presenting the principle.

A vertical wire F on the "car" represents the path the object (plastic bead) would appear to take when viewed by an observer A moving with the car. This vertical wire is *not* attached at E. By sliding the "car" on the track to a point where the bottom of wire G (unattached at the bottom) is in line with F, wire G will represent the approximate path that the body will *seem* to take as viewed by an observer at station B as the "car" with falling body goes by him.

By rotating disk B' about axis L (which represents the earth turning on its axis) until F is in line with the bottom (free end) of H, wire H will represent the approximate path that the falling body will *seem* to take when viewed by an observer at station C some distance from the surface of the earth —for example, one or two thousand miles.



THE PARKER ANDERSON STUDIO

Now, by rotating disk C' about axis K (here substituting a circle for an ellipse for simplified construction) until wire I (unattached at bottom) is in line with F, wire I will represent the approximate path of the falling object as it *appears* to an observer at station D which is somewhere outside of the orbit of the earth.

From the above steps one can demonstrate that if an object starts to fall from a fixed point in space E on a moving car on the earth's surface, then observers at stations A, B, C, and D will see the object take different paths, as shown approximately by wire forms F, G, H, and I.

Construction notes: Wire F is free at the top so that it can move with car. Wires G, H, and I are free at the bottom so that the disks can be rotated. One end of the wire bridge from which wires extend at E is attached at bottom to axis K. Disk B' (representing the earth) is attached only to disk C' so that it is free to move when disk C' is moved in reference to disk D'. Beads are placed on each of the path wires so that each course can be retraced by a moving object as the demonstration proceeds.

Results With Projects in General Science

By RICHARD G. TELFER, Kalamazoo Public Schools, Kalamazoo, Michigan

Junior high students enjoy activity. In school the science class should provide this experience. Science to be meaningful must live. Thus the experiences that we as teachers place before the students must be so designed that the members of the class will be eager participants. It is our responsibility as teachers to stimulate within each child an interest in becoming acquainted with the things about him. In doing so we will be helping these young people meet the challenge of modern society.

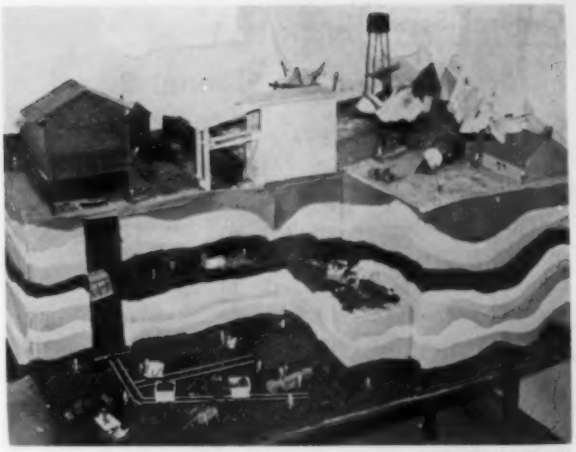
The usual response to the ideas just presented will very often sound like this. "Oh that sounds great on paper, but how do we actually do it? We just do not have the time to spend working out new ideas." The solution is not always an easy one, but if we as teachers are going to help prepare youth meet the years ahead we must be willing to adjust our methods to fit the needs of our various groups.

A teaching technique which is not new to many, but foreign to others, is the project type activity which will include every member of a class. This method is not easy but in many cases success may be gained by using it where other methods might well have failed. Project activity must never evolve into a general play period, when the students just do anything they please. To be of benefit to the group, everyone including the teacher must work hard to gain success in the unit being studied.

A step-by-step account of how a ninth grade general science class at Woodward School in Kalamazoo, Michigan, made a study of one of our important resources follows.

The general trend of a class discussion went something like this. "The new unit to be included in our work is *'Materials of Our Earth.'* How would you as a class like to go about making a study of this topic? Let us study just one very important material in good detail and from that we might get an understanding of many of the others."

Coal was selected as being very important to our way of life. The question which then arose was how to demonstrate that it is important? Hands went up. "Let us build a coal mine and in so doing we will learn about the industry."



SCHIAVONE STUDIO

Steps:

1. Secretary elected.
2. Questions were gathered.
3. Known facts compiled.
4. Letters were sent to organizations related to the coal industry for data about coal.
5. Materials for the study were collected on a local level.
6. Plans for the actual construction were suggested.
7. Materials of construction were brought in.
8. Reading and discussions helped to solidify ideas and plans.
9. Size and scale of project or model was worked out.
10. Construction of small parts and assembly of mine took place.
11. Reports were given to explain operation of different machines and general processes; this was done because each two pupils worked on different models which went into the whole effort.

Results:

A feeling of pride was felt by each student when they saw a picture of their project in the local paper. An appreciation of the importance of the coal miners and coal industry seemed to be present. A feeling of cooperation in each member of the group reflected in work that followed in other units.

Was it worth it? Three hundred forty student work-hours went into the project, a lot of time it is true, but so little time when one checks the work of those students a year later and finds 93 per cent of them continuing in advanced science courses. Let a project help make science live for your students.

General Science

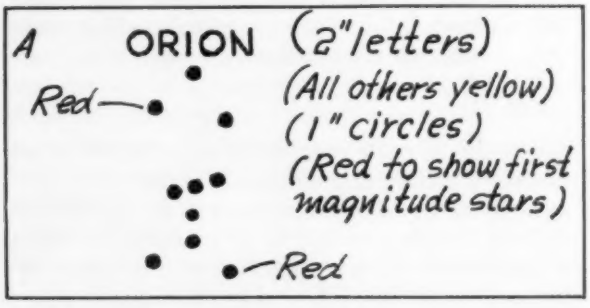
Science and the Flannel Board

By C. LEROY HEINLEIN, New Woodward Junior High School, Cincinnati, Ohio

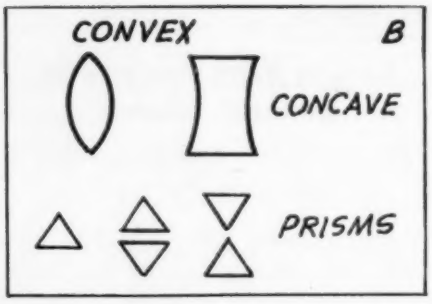
The felt board or flannel board is usually thought of and utilized as a visual teaching device for elementary schools. It has definite value with older children or adults. I have found this especially true in its use with ninth grade science classes. The objectives in its use were: to stimulate interest, to provide easy explanations of science principles and facts, to develop the creative abilities of boys and girls, to establish relationships, and to give a needed change from the traditional chalkboard demonstration.

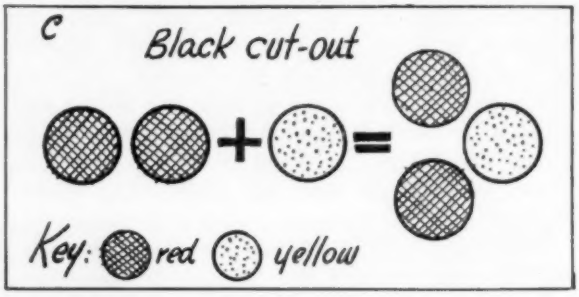
I constructed my board using a piece of beaver board, three feet by five feet, covered with inexpensive flannel (any light color), and framed with two-inch wooden strips. The entire board cost approximately four dollars. Construction paper of contrasting colors, backed with small strips of sand paper, felt, or flannel, was used to form silhouettes, forms, and outlines. Flannel or felt cutouts can be used instead of construction paper if desired. Children can, and did, make and manipulate most of the cut-outs.

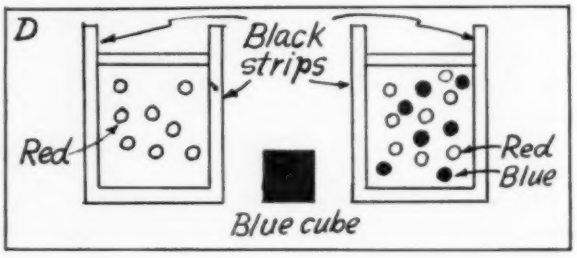
The teaching of constellations in astronomy was particularly fun. One-inch circles of various colors of construction paper were used to represent individual stars, and with them one or many constellations could be shown at a time. Different colored circles could be used to point out the brightest stars in a constellation or a particular star (A). A



display of constellations already prepared formed one important identification question in a written test—the children identifying the constellations displayed. Letters were cut out and used in the spelling of constellation names. In a study of light, the shapes of convex and concave lenses were cut out and manipulated (B).

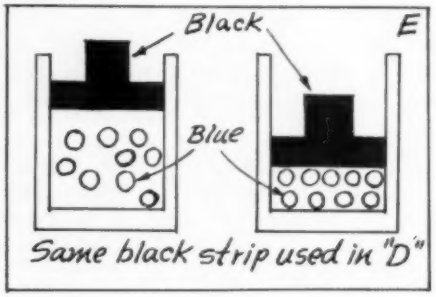




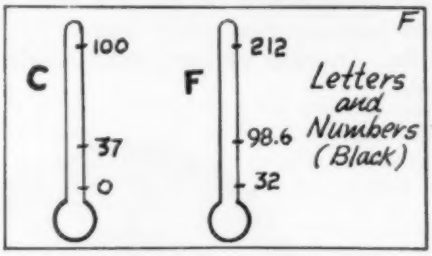


Circles of various colors (the same used in astronomy) were used to represent molecules of hydrogen and oxygen in a demonstration of the composition of water (C). This has many other applications in the study of the composition of materials.

Circles also represented molecules in a demonstration of what happens when a substance is dissolved (D). With the addition of black strips to represent the sides of a cylinder and a cut-out of a piston to fit the cylinder, the circles could again be used to represent air molecules. It was *easy* to show how air molecules are pushed closer together when you move a piston down a cylinder (E).



Thermometers cut out of red paper were used in a study of heat. A "C" and an "F" were placed at the top of each thermometer. Alongside each thermometer the children were asked to place numbers for the fixed points of each scale. Other numbers to show various temperatures (for instance, the temperature of the human body) were used. Comparison between scales was shown by the use of numbers (F).



These represent but a few of the uses my classes have made of the flannel board. It is an excellent way to illustrate a student report. There are definite applications of it in the teaching of electricity, sound, simple machines, plants, planets, and other units. Each new topic presents a new use—especially if the children are given a chance to plan, construct, and demonstrate different ideas. Before long a complete collection of forms and shapes can be accumulated and reused. Perhaps the chalkboard *is* easier to use, but it is not nearly the fun!

General Science

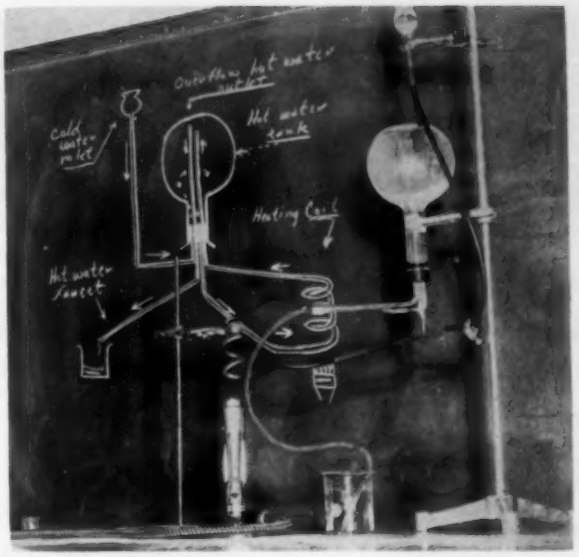
To Demonstrate the Hot Water Heater

By ROBERT S. JAQUISS, Seward Public Schools, Seward, Nebraska

I have been distressed in the past by my own inability to demonstrate adequately to my general science class the workings of a hot water heater. I found the diagrams given in the textbook and the other references that I made use of inadequate. One called for the use of a glass tube that was to be the "heating coil." I found that with very little heat this formed bubbles inside the glass and the uneven distribution of heat caused the glass to break. I did substitute a piece of copper tubing for the coil, but of course one cannot see through the copper.

This year when the problem again arose, I set the wheels into motion and came up with what I think is a fairly good answer to the problem.

The materials needed are: a length of copper tubing bent into a coil similar to the coil of an old-



fashioned water heater, a four-hole stopper made by boring two more holes in a two-hole stopper (this was done very easily by the shop instructor on the drill press—be sure to use a large enough drill), a 500-ml flask, two right-angle bends of glass tubing with the long end long enough to reach the bottom of the flask when inserted in the stopper, two right-angle bends with ends long enough to reach just through the stopper, several lengths of rubber tubing, broken-stemmed thistle tube, beaker, and pinch cock.

This apparatus is assembled as shown in the accompanying illustration. The glass tubing makes it possible to watch the progress of the water as it moves. Coloring the water is not too effective as the color soon disperses, but a small amount of fine sawdust (such as found in a box of chalk) will soon soak up and be carried about by the movement of the water. Because of the sawdust, the cold water tubes should not stick through the stopper any farther than just flush with the surface. The hot water tube from the heater coil is placed so that it will not be quite as high as the hot water outlet from the "tank." This will assure a water-filled circuit. The hot water will run only when the system is full. The flow is controlled by how much cold water is let into the cold water inlet. If the water level in the tank were allowed to fall below the hot water outlet from the heater coil, the delicate balance which makes the water heater work may be upset. When the coil is heated, water may spurt from the upper end in an undesirable fashion.

I found that this seemed to answer all questions. The movements were easily observed by the class.

Astronomy Study Aids

SPITZ JR. PLANETARIUM

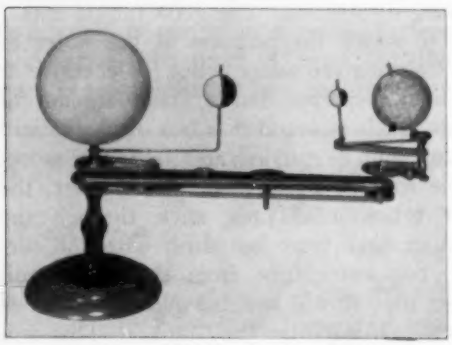
No. 701. A new visual teaching aid brings a knowledge of the heavens into your classroom or home. A plastic globe is perforated with small apertures and contains a pinpoint light source inside. Stars and constellations are projected on the ceiling. A dome is helpful but not necessary. Adjustable for date and latitude. Size 14½" high, 7½" square base. Weight 3 lbs. Operates on 110 volts. Complete with 32-page star guide. **$15.00**

TRANSPARENT GLOBES

No. 736. Combination globe device consists of an outside celestial globe in which is mounted a brightly colored terrestrial globe. Star globe has names of stars and constellations and contains a unique sun pointer. Terrestrial globe has names of countries and oceans and is mounted on a rotating axis. The device may be used to demonstrate many earth-sky-sun relationships and to simplify basic concepts in astronomy and geography.

No. 736-ST-12 12" Celestial Globe with 6" Terrestrial Globe mounted in cradle base **$42.50**

No. 736-ST-20 20" Celestial Globe and 6" Terrestrial Globe mounted in tripod base **$106.25**



TRIPPENSEE PLANETARIUM

No. 708. This demonstration device shows the relative position and motion of the Sun, Earth, Moon, and planet Venus. Simplifies teaching the rotation of the earth, the annual revolution around the Sun, day and night, change of seasons, and the mechanics of eclipses. This is an orrery-type device and not a projection planetarium. Constructed of brass with chain drive gears. Arm length is 16½", overall height 16". Hand operated. **$85.00**

OPTICS STUDY KITS

No. 722. Optical Kit. An American Industry Educational Hobby product. Enables one to build working telescope and microscope and to perform many basic experiments in optics. Full instruction book. **$22.50**

No. 721. "Learn by Doing" Optics Kit. Contains 14 lenses for making model optical instruments. 88-page handbook with instructions for 40 experiments and 24-page teachers manual. **$12.00**

Science Associates

194 Nassau Street Box 216 Princeton, N. J.

NSTA Activities

Officers and Directors for 1955–56

With the announcement of the 1955 election results at the banquet session of the Cincinnati convention, the Board of Directors to govern and guide NSTA affairs during the year beginning July 3 took shape as follows:

EXECUTIVE COMMITTEE (one-year terms)

President, Robert Stollberg, San Francisco State College, California

President-Elect, John S. Richardson, The Ohio State University, Columbus

Retiring President, Walter S. Lapp, Overbrook High School, Philadelphia, Pennsylvania

Secretary, Dorothy Tryon, Redford High School, Detroit, Michigan

Treasurer, Richard H. Lape, Amherst Central High School, Snyder, New York

(*Executive Secretary,* Robert H. Carleton, NSTA Headquarters, National Education Association, Washington, D. C.)

REGIONAL DIRECTORS

Region I (terms expire 1957):
Fletcher G. Watson, Harvard University, Cambridge, Massachusetts
Dorothy W. Gifford (alternate), Lincoln School, Providence, Rhode Island

Region II (terms expire 1956):
Charles G. Gardner, Grant Junior High School, Rochester, New York
G. Marian Young (alternate), New Lincoln School, New York City

Region III (terms expire 1957):
Robert T. Lagemann, Vanderbilt University, Nashville, Tennessee
Howard B. Owens (alternate), Northwestern High School, Hyattsville, Maryland

Region IV (terms expire 1956):
Ruth Armstrong, Fort Smith Junior High School, Fort Smith, Arkansas
Otis W. Allen (alternate), Greenwood High School, Greenwood, Mississippi

Region V (terms expire 1957):
Paul Klinge, Thomas Carr Howe High Schol, Indianapolis, Indiana
Violet Strahler (alternate), Stivers High School, Dayton, Ohio

Region VI (terms expire 1956):
J. Donald Henderson, University of North Dakota, Grand Forks
Merten M. Hasse (alternate), Central High School, Aberdeen, South Dakota

Region VII (terms expire 1957):
Herbert A. Smith, University of Kansas, Lawrence
Frederick B. Eiseman, Jr. (alternate), John Burroughs School, Clayton, Missouri

Region VIII (terms expire 1956):
Robert A. Rice, Berkeley High School, Berkeley, California
Gertrude W. Cavins (alternate), San Jose State College, California

DIRECTORS AT LARGE (terms expire 1956)

Glenn O. Blough, University of Maryland, College Park
Wayne Taylor, Denton High School, Denton, Texas

Regional Conference

Austin, Texas, October 6-8

Complete details on this meeting to be held in cooperation with the Oak Ridge Institute of Nuclear Studies will appear in the September issue of *TST.*

Summer Conference

University of Wisconsin, Madison

June 29, 30, and July 1

Theme: Keeping Up-To-Date With The Content And Methods Of Teaching Science

One summer attraction that science teachers will want to take in is this Science Teachers Conference, planned in cooperation with the University of Wisconsin Summer Session. In line with the theme, the program will feature reports from many well-known staff members of the various science departments on new developments in their respective fields, and work-discussion groups for the elementary, junior high, and senior high school levels. A demonstration lecture on astronomy is scheduled for the evening of June 29, and a banquet session with speakers for June 30. All sessions will be held at the University of Wisconsin Union. A printed program will be mailed to all NSTA members early in May.

The program for the Science Teachers Conference has been arranged by the following committee: Ira C. Davis, *Chairman,* University of Wisconsin, Madison; Clarence Boeck, University of Minnesota, Minneapolis; Mrs. Muriel Bueschlein, Chicago Teachers College, Illinois; Robert Cooper, Ball State Teachers College, Muncie, Indiana; Mrs. Betty L. Wheeler, University of Michigan Extension Service,

Mt. Pleasant; Nelson Lowry, Township High School, Arlington Heights, Illinois; Mary Rowe, State Teachers College, Eau Claire, Wisconsin; Dean Stroud, Ames Hiatt Junior High School, Des Moines, Iowa.

Another opportunity for science teachers is the special four-week Workshop, July 5-29, with graduate credit, on "Organizing and Teaching a Continuous Program in Science from Grades 1 to 12, Inclusive." For additional information on the Conference and Workshop, write to Professor Ira C. Davis, Department of Education, University of Wisconsin, Madison 6.

Board of Directors Meeting

The 1955 annual meeting of the Board of Directors, which is held each year at or near the place of meeting of the NEA, will be held July 2 and 3 on the Wisconsin campus.

NEA Luncheon Meeting

A luncheon meeting for all science teachers attending the NEA Convention in Chicago, July 3-8, is being planned for Monday, July 4, at the University of Chicago. Check the NEA Program for details or write to the chairman for this meeting, James G. Harlow, Department of Education, University of Chicago.

Life Members

Some members receive life memberships as Christmas presents; some sign up at conventions and conferences; some change their classification of membership at renewal time; but all are giving their support to their professional organization.

The first of the new Life Member Certificates were presented at the Life Members' Breakfast for those in attendance at the Cincinnati Convention. Those who were not present received their certificates by mail. We hope our life members like them.

Since the last roster of new life members was presented in the October 1954 issue of *TST*, 36 new names have been added. This brings our total to 146. We consider this to be further evidence of the progress and growth of NSTA. We welcome the following new life members:

ALYEA, HUBERT N., Princeton, New Jersey
AUERBACH, BERNARD, Rye, New York
BARSNESS, C. O., Fergus Falls, Minnesota
BECK, ALFRED D., New York, New York
BROWN, WILLIAM F., Talladega, Alabama
BUTLER, ALFRED B., Pullman, Washington
CORNELL, RUTH E., Wilmington, Delaware
DOMM, JOHN, Mineral Wells, Texas
DUBBS, ROBERT J., Shamokin, Pennsylvania
FINLEY, ALBERT C., Choteau, Montana
GEORGISON, CLIFFORD G., Richmond Annex, California
HALE, HELEN E., Towson, Maryland
HENRICH, ROBERT, Richland, Washington
HERSHMAN, GEORGE E., Valparaiso, Indiana
INNES, KENNETH F., JR., San Francisco, California
JACKSON, CRAYTON T., Indiana, Pennsylvania
JAMES, LOUSETTE, Weldon, North Carolina
KOCH, RICHARD R., Delaware City, Delaware
KRIVOHLAVEK, ERNEST H., Cushing, Oklahoma
KUHNEN, S. MARIE, Upper Montclair, New Jersey
LAMBERTON, BERNICE G., Washington, D. C.
LOVERUDE, THOMAS H., Aberdeen, South Dakota
LYON, DON O., Iroquois, South Dakota
MCALLISTER, RICHARD P., Fergus Falls, Minnesota
MECUM, IDA, Richland, Washington
POWERS, MARY C., Lockport, Illinois
READ, JOHN G., Boston, Massachusetts
RUBERTO, FRANK A., Revere, Massachusetts
SAY, JOHN, Rock Springs, Wyoming
SCHELD, WILLIAM H., Westport, Connecticut
SCHENBERG, SAMUEL, Brooklyn, New York
SCOTT, WARREN R., Richland, Washington
STRAHLER, VIOLET, Dayton, Ohio
VAN HOOFT, GORDON E., Albany, New York
WARD, HAROLD E., Huntington, West Virginia
WILLIAMS, MARY, Evansville, Indiana

Advisory Council Reorganized

Seldom does a group vote itself out of existence. But that is exactly what the NSTA Advisory Council on Industry-Science Teaching Relations did at Cincinnati. It did so because a better idea came along.

Organized in 1947, the Advisory Council has been comprised of 10 representatives of science teaching and 10 representatives of industry. Its pioneering efforts have produced numerous useful results: (1) a study of criteria for the evaluation of commercially sponsored teaching aids; (2) the development of the NSTA Packet Service; (3) a plan whereby consultation in the production of teaching aids can be arranged through NSTA; (4) a fact-finding study and report on *How Science Teachers Use Business-Sponsored Teaching Aids* (still available from NSTA, price $1.00); (5) more than twenty regional and national conferences on industry-science teaching relations; (6) the formation of the Business-Industry Section of NSTA. Morris Meister was first chairman of the Council; Elbert C. Weaver and John S. Richardson have likewise served as chairmen.

After a full year of study and in consultation with the NSTA Board of Directors, the Advisory Council

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has now been terminated in favor of a Committee on Business-Industry Relations. This new committee will be comprised of the NSTA Executive Committee and the Executive Committee of the B-I Section. It is expected that the two groups will be brought into even closer working relations and on a much wider scale than in the former Council. The Packet Service, Future Scientists of America activities, *TST* advertising, and other forms of relations with business-industry groups may well be reviewed by the new committee.

As of July 3, the new committee will be composed of Robert Stollberg, Walter S. Lapp, John S. Richardson, Dorothy Tryon, Richard H. Lape, and Robert H. Carleton (all of NSTA); the B-I Section will be represented by Reginald G. Sloane (Standard Oil Company, N. J.), Robert D. Stanton (General Electric Company), L. R. Bateman (U. S. Steel Corporation), Margaret Delaney (American Institute of Baking), Leo Murphy (Crucible Steel Company), and Elizabeth Robinson (National Association of Home Builders).

Cooperation with other Groups

The membership at large will be interested and gratified to learn of the extent of field service and inter-society cooperation involving NSTA. Here is a brief rundown on such efforts since January 1, 1955.

1. January 19th your Executive Secretary represented the Association in a conference on the improvement of science teaching called by the Virginia State Department of Education.

2. During January, conferences were held with representatives of the Cancer Institute of the National Institutes of Health and the Public Health Service. A manuscript prepared by one of these is now being reviewed by two members of the Association.

3. David McNeely of Summit High School, New Jersey, represented the Association at a meeting of the National Conference for Cooperation in Health Education held at New Haven, Connecticut, early in February.

4. James G. Harlow was NSTA's official representative and a program participant in a conference on scientific manpower held by the American Society of Military Engineers in Chicago in February. The meeting was also attended by Assistant Executive Secretary John H. Woodburn.

5. Your Executive Secretary was the guest speaker at a meeting of the Monmouth County, New Jersey, Section of the American Chemical Society, February 10. Chemistry teachers and their "top students" from the county's high schools were guests of honor.

6. We were invited to participate and suggest speakers to take part in a conference of the Research Committee of the National Association of Manufacturers held in New York City, February 25. NSTA representatives included Rolland Gladieux of Kenmore, New York, Alexander Efron of Stuyvesant High School, New York City, and your Executive Secretary.

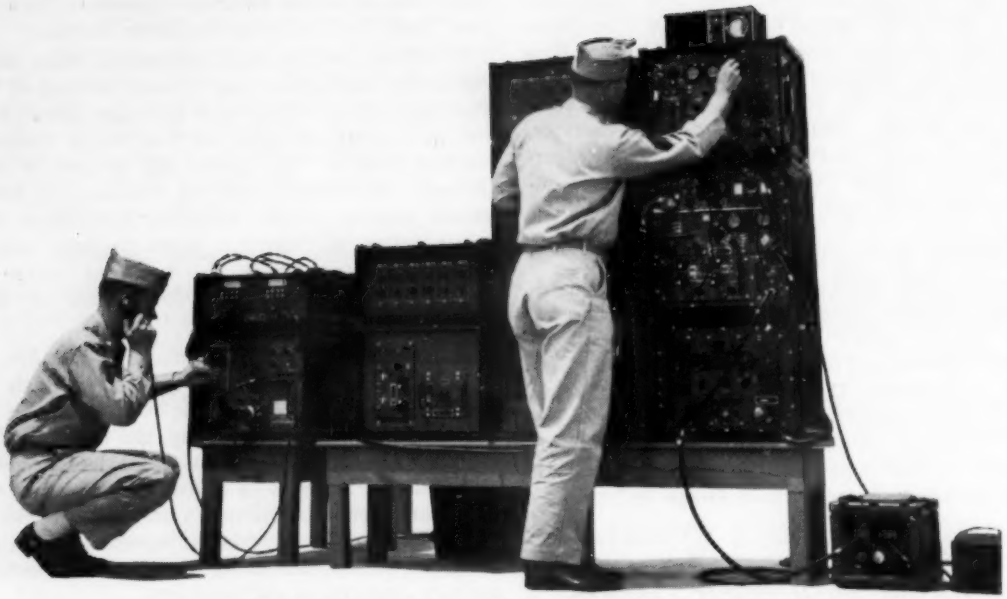
7. During the Cincinnati convention, plans were advanced for two forthcoming regional meetings of NSTA. The first of these will be held in Austin, Texas, October 6-8, in cooperation with the Oak Ridge Institute of Nuclear Studies. The second will be held in Atlanta, Georgia, December 27-30, in conjunction with the annual meeting of the American Association for the Advancement of Science. Joint programs are being planned involving NSTA, the American Nature Study Society, and the National Association of Biology Teachers.

8. During the Cincinnati convention, the first meetings of an NSTA committee on tests in high school chemistry were held. Under the chairmanship of Elbert C. Weaver of Phillips Academy, the group of fifty or more will work as a sub-committee of the Committee on Tests of the Division of Chemical Education of the American Chemical Society. Your Executive Secretary has also accepted invitations to represent NSTA on the Division's committees on the teaching of chemistry, and summer conferences and institutes.

9. A conference on "The Production of Physicists" held at White Sulphur Springs, West Virginia, March 31-April 2, produced a number of proposals for joint efforts by NSTA, the American Association of Physics Teachers, and possibly other groups. Planned and conducted by the National Research Council Division of Physical Sciences and the American Institute of Physics, the conference heard major papers presented by Harold E. Wise of the University of Nebraska and past-president of NSTA, and Fletcher G. Watson of Harvard University and newly elected to the NSTA Board of Directors. A sub-committee of the conference was chaired by Philip G. Johnson of Cornell University and past president of NSTA. Your Executive Secretary was official NSTA representative and it was encouraging to find that a number of the physicists present hold NSTA membership.

10. Your Executive Secretary represented NSTA in a conference held April 4 by the Joint Council on Economic Education in New York City. The conference reviewed plans for a three-year study in conservation education under a $100,000 grant to the Council from Resources For The Future, Inc. The project promises to involve continuing advice and evaluation from science and conservation groups, both of which (through the Conservation Education Association and NABT) were ably represented by Richard L. Weaver of the University of Michigan.

All of which, it seems to the writer (your Executive Secretary), adds up to inescapable arguments for *all* science teachers to become members and share in the activities of NSTA and other science teacher organizations—if science teaching is to be professional and serve its highest purposes in the education of all boys and girls.



Tuning in for radio transmission. Each item of equipment is not much bigger than a suitcase.

A leapfrog telephone system for the Armed Forces!

A new communications system, which takes to the air when water or rough terrain prevents the stringing of wires, has been developed for the U. S. Signal Corps by Bell Telephone Laboratories.

It uses cable and radio relay interchangeably over a 1000-mile range. It is easily portable, unaffected by climate, and rugged enough for global use. Twelve voices travel at once over a pair of wires or radio waves — as clearly and naturally as over the regular telephone system.

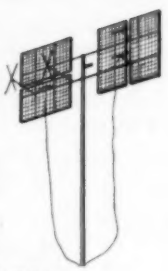
This is the first time a completely integrated wire and radio system of this large a channel capacity has been available for tactical use by the Armed Forces. It is already in production at Western Electric, manufacturing and supply unit of the Bell System.

The new system is a joint achievement of the Signal Corps, Bell Laboratories and Western Electric . . . one of the many results of long and fruitful co-operation. It shows again how techniques which the Laboratories develop contribute to our national strength.

Bell Telephone Laboratories

Improving telephone service for America provides careers for creative men in scientific and technical fields

Amplifiers like this are used every 5¾ miles in cable portions of the system. They are weatherproof, can be used on a pole or the ground, and will even work under water. The system uses a spiral wound cable developed by the Signal Corps.



Easily raised antennas send or receive for the radio links.

FSA Activities

Recognition Awards for Science Teachers

Entries in the 1955 Program show that teachers are looking for new ways to give adequate attention to superior students, improve their students' study habits, work more closely with other departments, obtain equipment that Boards of Education won't provide, get their routine chores done more quickly, and develop all sorts of ideas for reviving and holding student interest in science courses and careers.

Cash awards were presented to three of the four winning teachers by Walter Morrison of the American Society for Metals at the 1955 Convention of the National Science Teachers Association held in Cincinnati. Robert B. Leitch, Santa Monica, California, received the $400 award for adapting the ninth grade general science course to take care of those students for whom the regular course would be something less than a challenge. Although illness prevented John L. Ewart, Phoenix, Arizona, from being at the convention, he received $300 for a teaching unit on atomic energy. A $200 award went to George W. Hall of Tulsa, Oklahoma, for an outstanding example of how to use organizations and resources within his community to improve his science teaching. Alfred L. Lazow of Evanston, Illinois, won the fourth place award of $100 by showing how many science principles radiate from the kinds of classroom activities ordinarily conducted in routine fashion in many classrooms.

We sincerely commend all of the teachers who so generously gave their time to participate in this program. John B. Chase, Jr., Assistant Professor of Education at the University of Virginia, organized a committee of judges to select the winning entries. Brief annotations of the entries will appear in an early issue of *The Science Teacher*.

Other Programs

Entries in the 1955 Program of Science Achievement Awards for Students must be sent to the Regional Chairman by May 15. Remember, this is an ideal program to provide recognition for individual students in any junior or senior high school.

Plans for the West Coast Summer Conference are well under way. We are looking forward to a solution to the problem of keeping mathematics from being too much of a hazard to high school science students. In addition, participating teachers can expect to enjoy many valuable interviews and visits in government, industrial, and university laboratories.

FSA Student Chart Contest

With the completion of this year's program, we can be sure that over 500 students became very familiar with individual scientific principles or their applications. In addition, the program stimulated the development of outstanding ability in portraying scientific principles graphically. The names of the winners follow.

(Student's name, school, title of project, and teacher)

FIRST PLACE:

Richard V. Cronk, St. Petersburg H. S., St. Petersburg, Fla.; "Human Blood Cells"; A. C. Davis.

SECOND PLACE:

Dolores K. Mastroni, Little Flower H. S., Philadelphia, Pa.; "Isaac Newton"; Sr. Mary Isadore.

THIRD PLACE:

Elizabeth Hunter, Ball H. S., Galveston, Texas; "Sulfur"; Greta Oppe.

Mike Noce, Roosevelt H. S., Portland, Ore.; "Optical Corrections"; Alice L. Mackley.

Grace Dornoff, Catholic Girls H. S., Los Angeles, Calif.; "Chemical Activity Series"; Sr. Mariam Rita.

Marshall Benson, Philip Schuyler H. S., Albany, N. Y.; "Simple Machines"; Mary J. Warren.

Betty Bruehling, McDonnell H. S., Chippewa Falls, Wis.; "Tropisms"; Sr. Mary Julian Eymard.

Jim Hamilton, Senior H. S., Auburn, Wash.; "The Three Producers of Energy"; Gordon A. Heritage.

Don Sanborn, Jr., High School, Springfield, Ill.; "How the Scientific Method Is Applied"; Carroll C. Hall.

Lee Anna Fick, Blair H. S., Blair, Neb.; "The Ten Basic Life Functions"; Glen Warneking.

Jane McMicken, Ft. Atkinson H. S., Ft. Atkinson, Wis.; "Structure and Functions of the Human Brain"; Robert J. LaHann.

We commend the participating students and their teachers for making the 1955 FSA Student Chart Contest a success. Our thanks go to the W. M. Welch Scientific Company, to the judges who made the preliminary selection, to the parents who helped make materials available to the students, and to the teachers for their patient guidance. We are especially grateful to Mr. Hugh Brown who so capably represented the sponsor.

Check the Harcourt, Brace Science Program
before choosing next fall's texts!

General Science

Science for Better Living Series
by Brandwein, Hollingworth, Beck, Burgess

- **YOU AND SCIENCE (9)** Published in January
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HARCOURT, BRACE AND COMPANY · New York 17 · Chicago 1

Book Reviews

GENERAL SCIENCE TODAY. Phil R. Gilman and L. E. Van Houten. 630 pp. Rand McNally and Company. New York. 1954.

The authors of this book have attempted the herculean task of acquainting the pupil not only with the important concepts of the physical and biological world but also of helping him acquire a method by which he can solve problems confronting him in real life situations. The emphasis is on the physical sciences and the selection of topics is good. The authors appear to have chosen carefully those concepts which would appeal to and have a functional value for pupils of seventh to ninth grade. Chapters on communication and atomic energy are especially well done. The book is up to date in its approach and in the information given, although in several cases the short treatment of a topic might lead to misunderstandings.

It is to be regretted that the biological sciences have received such meager treatment. Only one chapter on the plant and animal kingdoms, an encyclopedic treatment, has been included. An additional chapter on physiology and health and an occasional reference to living organisms are scattered through the book.

Many teaching and learning helps appear throughout. Almost every page has excellent photographs or drawings which are a definite aid in understanding or enrichment of the discussion. Self checking questions are to be found at the end of topics. Also at the conclusion of each unit is a vocabulary list, a series of pupil activities called, "Learning to Use Science", and a self test entitled, "What Do You Know About Science?" A teacher of general science emphasizing the physical world would find interest in this book.

DOROTHY V. PHIPPS
Chicago Teachers College
Chicago, Illinois

BETTER TEACHING THROUGH ELEMENTARY SCIENCE. Julian Greenlee. 240 pp. $2.50. Wm. C. Brown Company. Dubuque, Iowa. 1954.

This monograph takes the reader into a school where he lives with the deeds, thoughts and innermost soul searchings of Miss Imig, a first grade teacher, Mr. Wilkenson, a high school science teacher, Mr. Sorenson, the school principal, as well as the many children of the school and their parents. Mr. Greenlee uses a fictionalized approach starting with Miss Imig's magnanimous thoughts at the beginning of the day, proceeding to the introduction of salamander eggs by one of the children and the multitude of problems pertaining thereto, and concluding with an explanation as to how the problems were handled by Miss Imig with the help of the science teacher.

The story centers around the growth of Mr. Wilkenson from a cold, scientific personality to a warm, human person with a deep understanding of the needs of children and a sound over-all philosophy of education. It also concerns the growth of children in science understandings and in scientific attitudes. The transition of Mr. Wilkenson is brought about by Miss Imig who is the epitome of all the right things that have ever been said or implied about first grade teachers, and by Mr. Sorenson, the principal, who is just too righteous to be true.

This reviewer cannot understand why the author used the fictionalized approach. Mr. Greenlee's factual writing in this field is sound and useful and of value to many readers, but his material (which is good) suffers by this treatment. It is questionable if readers will, or should for that matter, plow through the extraneous fictionalized and often inane patter that this monograph contains in order to get from it the good that is there in abundance.

Mr. Greenlee has a live, practical, sound, effective and logical viewpoint about education in the elementary school. He believes among other things that education should not be pressured, that children should plan and develop their studies, that children should read for an immediate purpose, that teachers need not know all the answers, and that children can and do think critically when given the opportunity. From this alone it is quite obvious that this little book has a message.

We believe that Mr. Greenlee has a large audience that would agree with this philosophy, and others which should read it so that they may profit. However, we also believe that it is unfair to expect this audience to live with stereotyped characters, with completely artificial dialogue, with faulty transition, and with contrived situations that enable the author to step in, in order to get this philosophy. Teachers are intelligent, busy people and they can take their philosophy straight from the shoulder.

FRANKLYN M. BRANLEY
State Teachers College
Jersey City, New Jersey

ALL ABOUT THE STARS. Anne Terry White. 144 pp. $1.95. Random House, New York. 1954.

The author has handled a difficult subject in a most interesting and elementary fashion. She has told the story of the stars in a single, clear, yet forceful style. Not only is it geared to the comprehension of the young adolescent but adults will find it a reservoir of pleasurable reading as well. The content is rich in astronomical information, most of which is factual and based on sound research.

This book encompasses a wide range of reading material on the heavens replete with facts and figures. It includes data on the planets, the sun, galaxies, scientists, and "all about the stars."

An excellent feature of the writing is the organization and sequence of the subject matter. The illustrations, that appear in every chapter, do much to heighten the readers interest. A rather complete index makes the book useful for purposes of reference.

ALBERT PILTZ
University of Florida
Gainesville, Florida

MISS PICKERELL GOES TO THE ARCTIC. Ellen MacGregor. 126 pp. $2.25. Whittelesey House. New York. 1954.

This book, interwoven with interesting information about the Arctic, is a delightful addition to the Miss Pickerell Series which has become so popular with 8 to 11 year-olds. Adults will also enjoy reading this amusing story to children in this age-group.

Children, young and old, will laugh and be caught in the suspense with Miss Pickerell and her party as they fly into the tundra to rescue a lost Weather Expedition. Readers will find themselves feeling as "lost" as the "lost weather expedition" when their heroes' and heroine's plane makes a forced landing on the beautiful but hazardous Arctic ice-field. And they will sigh with relief as the story speeds on to a happy ending. The members of the Weather Expedition are found; radio contacts are made with the outside world; our ingenious Miss Pickerell takes a harrowing sail with her black umbrella and accidentally snaps a valuable picture for the expedition; everybody returns home safely from their Arctic adventure; their mission is accomplished!

JUNE E. LEWIS
State University Teachers College
Plattsburgh, New York

SKYROCKETING INTO THE UNKNOWN. Charles Coombs. 256 pp. $4.00. William Morrow and Company. New York. 1954.

Written by an aviation-minded author of youth fiction, under the inspiration of Douglas Aircraft's aeronautical development staff, *Skyrocketing into the Unknown* may fall short of being a definitive history of the development of high speed ond high altitude flight. But it does serve the useful educational purpose of introducing youth to the significant aeronautical developments now taking place as man pierces the sonic barrier, probes the thermal barrier, and seeks the keys to loosen the chains of gravity.

The story Charles Coombs tells is intrinsically interesting. What makes it valuable for supplementary reading on the junior or senior high bookshelf is its skillful integration of the young reader's classroom world of elementary science with the progress and problems of the modern pioneers of aeronautical science. Into the discussion are woven such general science learnings as Newton's Third Law of Motion, the nature and composition of air, the structure of the atmosphere, and the mechanism of the human body.

FREDERICK B. TUTTLE
State University Teachers College
Plattsburgh, New York

GENERAL CHEMISTRY—A TOPICAL INTRODUCTION. Eugene G. Rochow and M. Kent Wilson. 602 pp. $6.00. John Wiley & Sons, Inc. New York. 1954.

The authors of this book state in the *Preface* their objective of presenting a beginning college text stressing principles and their applications. This they have done in a logical, concise, and thorough manner. From the first chapter on atoms, with the use and theory of the mass spectrograph starting on page three, to the last chapter (28), nearly half are concerned with the basic principles of chemistry. However, many modern applications of these principles are incorporated in an interesting and apt style. Interspersed are chapters on the more common elements and families; there are four excellent chapters on photosynthesis, biochemistry, chemotherapy, and radiochemistry. Very commendable and interesting are the chapters on "The Sea as a Chemical Storehouse" and "Our Resources".

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Molecular models and structures are used extensively and well. The newer inorganic naming system is used and the Brönsted theory is incorporated throughout in a non-crusading manner that permits the use of the H^+ ion and the concept of hydrolysis. Most of the mathematical equations are derived. The chemical equations are ionic when possible. The printing is exceptionally clear and devoid of errors.

It is evident that the authors assume a rather high level of intellectual development and application in the students using this text. The average college freshman would be quite overwhelmed by the chemical equations in Chapter 4 on "The Coinage Metals". A good foundation in high school physics and mathematics is prerequisite. Nevertheless, this is a concise general chemistry text with an excellent and somewhat different approach; basic principles are the skeleton, but the many applications and the descriptive sections give it a well-rounded and attractive form.

J. W. NECKERS
Southern Illinois University
Carbondale, Illinois

COLCHICINE—IN AGRICULTURE, MEDICINE, BIOLOGY, AND CHEMISTRY. O. J. Eigsti and Pierre Dustin, Jr. 470 pp. $5.00. The Iowa State College Press. Ames, Iowa. 1955.

Science teachers may recall a project launched in the late thirties in which they were invited to experiment with samples of colchicine. This project, conducted by the senior author, represents only a very small facet of the data gathering which produced *Colchicine*. By count, 1,846 citations appear in the separate chapter bibliographies.

For teachers who are anxious to advance beyond the description-classification stage of biology teaching, this book is an appropriate and rich reference source. Treating as they do the unusual sight which appears in a microscopic field focused upon tissues treated with colchicine, namely, the halting of nuclear mitoses at metaphase, the authors take their readers into a very significant biological process.

Implications of polyploidy range all the way between cancer control and the production of seedless watermelons. These implications provide for the practical-minded reader, a convenient bridge between very pure and definitely applied research.

The book is not written for high school students. However, teachers can find much supplementary material for the standard biology course. The many experiments to which the authors refer can stimulate appropriate topics for student research projects.

JOHN H. WOODBURN
National Science Teachers Association
Washington, D. C.

ESSAYS IN SCIENCE. Albert Einstein. 114 pp. $2.75. Philosophical Library, Inc., New York. (An authorized English translation from the volume *Mein Weltbild* originally published in Amsterdam, 1933.)

This abridged edition of *The World as I See It* is reprinted to give the general reader an opportunity to examine some of the distinguished scholar's papers dealing with science. Papers include references to Kepler, Newton, Maxwell, Planck, Niels Bohr, and others. Chapters are concerned with such topics as method in theoretical physics, the theory of relativity, and scientific truth.

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Audio-Visual REVIEWS

THE WONDERWORLD OF SCIENCE (BOOK 8). 12 Filmstrip series, 1954. $36 Color. Charles Scribner's Sons, 597 Fifth Ave., New York 17, N. Y.

Recommendation: Suitable for upper intermediate and junior high school levels up to the eighth grade in general science.

Content: Prepared to accompany Meister's *The Wonderworld of Science*, the twelve filmstrips are grouped in six pairs. Each pair develops a basic concept or generalization from each of six major science areas in the text. The following topics are covered: Our Neighbors in Space; The Changing Face of the Earth; How New Plants are Produced; Moving Things from Place to Place; Speaking and Hearing; Atomic Energy for Better Health.

Evaluation: Although geared to a specific text, the series is well done and should prove useful as supplemental material with any textbook. Photography is excellent, and each frame is captioned. Teachers' Guide is included for each pair of filmstrips.

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ZOOLOGY FILMSTRIP SERIES. 10 Filmstrip series, 1954. $55 B&W. McGraw-Hill Texfilm Dept., 330 W. 42nd St., New York 36, N. Y.

Recommendation: Most useful on college level, but could be used with advanced high school biology students interested in detailed anatomical structures.

Content: Series correlates with Storer's *General Zoology*, for college level. Each filmstrip deals with a definite group of animals giving detailed information on anatomical features, systems, and functions. Photographs and drawings of illustrative members of each group are included. Set One consists of: Protozoans, Sponges and Coelenterates, Flatworms, Roundworms, Echinoderms. Set Two consists of: Mollusks, Annelids, Insects, Lower Chrodates, and Arthropods and Crustaceans.

Evaluation: Photography is well done, and each frame is captioned and labeled. Prepared under careful supervision, and seems to be technically accurate.

◇ ◇ ◇

THE FIRST ATOMIC PILE. 17 min. sound, 1954. B&W. Teaching Film Custodians, Inc., 25 W. 43rd St., New York 36, N. Y.

Recommendation: Suitable for senior high school and junior high school levels in general science, physics, and chemistry. It might also be used on the intermediate level.

Content: Excerpted from *The Beginning or the End* (MGM), it dramatizes the first test on the atomic pile at the University of Chicago in 1942. Portrays many Manhattan Project scientists such as Fermi and Compton. A briefing of an observer, in the form of a chalk talk, clarifies the objectives of the film for the audience. As meters whirl and panel lights flash, the first self-sustained chain reaction is born.

Evaluation: Prepared by the Motion Picture Committee of the NSTA, it has a well-organized content and is timely and suitable for school use. It should stimulate much interest, since the number of facts are held to a minimum, and each is well explained. It emphasizes the research attitude of scientists all over the world.

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CAREER: MEDICAL TECHNOLOGIST. 24 min. sound, 1954. $135 Color. Also free loan. National Committee for Careers in Medical Technology, 1785 Massachusetts Ave., N. W., Washington, D. C. Loan (service charge $2) from Committee on Medical Motion Pictures, 535 N. Dearborn St., Chicago, Ill.

Recommendation: Suitable for high school classes in biology and for the study of vocations in the medical field.

Content: Realistically portraying the role of the medical technologist in medicine and research, the film conveys the requirements, compensations, and appeal of this type of work. Focusing on a young girl and her three high school classmates, the presentation explores the educational requirements and training involved for this field. The key laboratory techniques are demonstrated with explanations as to why they are needed and what they accomplish. The social consequence of the work is emphasized by story background on some of the tests performed by medical technologists. Throughout the film the emphasis is on the importance of thorough training and the kind of job opportunities open to the successful graduate.

Evaluation: The film was sponsored by various medical societies to interest more young people in medical technology. Well acted and directed, the film is a professional job. It is a documentary film packed with information to show any young person exactly what is required for a career in medical technology.

◇ ◇ ◇

ZOO BABIES. 11 min. sound, 1955. $55 B&W, $110 Color. Coronet Instructional Films, Coronet Bldg., Chicago 1, Ill.

Recommendation: Suitable for primary level through grade four. Used in the study of elementary science and nature study.

Content: Filmed in the Chicago Zoological Park, questions about young animals are answered in this presentation of zoo animals and their offspring. The children's attention is directed to the physical characteristics and habits of baby monkeys, gnus, kudus, lions, peacocks, alligators, and bears. The parents feeding the young is illustrated, and the difference between mammals and non-mammals is emphasized.

Evaluation: Photography and sound is good. Commentary is for the very primary level. Should arouse much interest and discussion. Teachers' Guide is included.

◇ ◇ ◇

BIRTH OF A BUTTERFLY. 9 min. sound, 1954. $35 B&W. Sterling Educational Films, 205 E. 43rd St., New York 17, N. Y.

Recommendation: Suitable for use on intermediate, junior high, and senior high levels. Adapted to units on plants and animals in general science and biology.

(Please continue on page 160)

AUDIO-VISUAL REVIEWS— continued from page 159

Content: Shows the metamorphosis of the Monarch Butterfly. The young caterpillar feeding, the pupation, and the mergence of the adult is clearly seen.

Evaluation: Good photography with many close-ups. Color would seem to have been indicated for a film of this nature. Content is well-organized and the film should stimulate reading and discussion. Vocabulary is quite general and should be useful at most grade levels.

◇ ◇ ◇

HOW MANY STARS. 11 min. sound, 1954. $90 Color, $45 B&W. Moody Institute of Science, 11428 Santa Monica Blvd., Los Angeles 25, Calif.

Recommendation: Excellent for use in general science in junior high school, and astronomy in senior high school. Will also be useful in orientation and attitude building in physics and earth science classes. Was suggested for use in upper intermediate grades, but film has a difficult vocabulary.

Content: The modern concept of space begins with a consideration of the solar system. An imaginary trip is made to Alpha Centauri, at the speed of light, to clarify the meaning of a light year. Our galaxy is described and the sun's place in the galaxy is established. Various nebulae and galaxies are shown in photographs made through the 200-inch telescope. The number of stars within the range of our telescopes is computed and illustrated.

Evaluation: The color film was outstanding in photography and sound. It has a fine musical score, and should stimulate much interest in reading and further study of our universe. It is excellent background for an understanding of what is involved in time-space relationships. The brief message at the end of the film adds a note of dignity to the presentation. A Teachers' Guide is included.

✦ The paper on "Method In Science Teaching" was written by John Dewey; it was presented at a session of the Department of Science Instruction (NEA) held during the 1916 meeting in New York City. Dr. Dewey was Professor of Philosophy at Columbia University. Comments from today's readers of "Method In Science Teaching" will be gratefully received.

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